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ENGINEERING NEWS.

THE *City of Paris*, in making her first round trip back to Liverpool, steamed 498 miles in 24 hours on her last complete day out. While this is beaten by the *Etruria's* run of 503 miles in the same time, it is remarkable in a new ship. In June, 1888, the latter ship made the run in 6 days, 1 hour and 47 minutes, and her record was in miles per day—455, 458, 496, 485, 503, and 457. The *Umbria*, which crossed the ocean three days ahead of the *City of Paris*, made the trip in 6 days, 3 hours and 50 minutes as against 6 days, 5 hours and 55 minutes, the record of the latter ship. The best day's run for the *Umbria* was 454 miles. But in November last the *Umbria* made the run in 6 days, 2 hours and 32 minutes. As the *City of Paris* has thus only 3 hours and 23 minutes to take off her time, her chance of breaking all previous records is very good as soon as her machinery is in good working and running order.

Since writing the above the *City of Paris* has reached this port on her third trip across the Atlantic, and has broken all previous records with a time of 5 days, 23 hours, and 7 minutes. Her log from Queenstown to Sandy Hook, in miles per day, stands 445, 492, 504, 505, 511, 398, thus in three consecutive days she beat the 503 miles of the previous fastest ship, the *Etruria*, and the voyage to this port was shortened 2 hours and 48 minutes on former records of ocean racing. As the *City of Paris* encountered strong head seas on her first day out, and a dense fog on the last day that compelled her speed to be diminished, it is safe to foretell that this wonderful ship will yet eclipse her own brilliant record.

THE COMPOUND ENGLISH LOCOMOTIVE "Pennsylvania," recently brought over for test for the Pennsylvania Railroad, is stated by Supt. PITCAIRN, according to recent interview, to be doing very well, the principal difficulty being slowness in starting, which Mr. PITCAIRN justly remarks is a very important point. The "Pennsylvania" seems to save 8 lbs. per mile of coal, which it is well remarked "is a consideration, *other things being equal*." The engine weighs 95,200 lbs., and her tender empty 27,000 lbs. She has 6 ft. 3 in. drivers, two 14×24 and one 30×24 in. cylinders. She is in charge of an English runner and machinist, by a very proper precaution, charged with seeing that the new engine has every chance. She has hauled a train weighing, including engine, 232 tons up a grade of 70 ft. per mile, 4¼ miles long, at 33 miles per hour, which is a fair but in no way remarkable performance. The difficulty in starting has been found in nearly all the trials of the "Pennsylvania" so far.

THE NORTHERN PACIFIC AND WISCONSIN CENTRAL companies have finally closed their traffic contract which has so long been under discussion. Under this contract the Wisconsin Central receives business from the Northern Pacific at Ashland and St. Paul, and delivers it in Chicago; and it receives at Chicago business destined for the Northern Pacific. Of its gross earnings the Wisconsin Central retains 35 per cent., and expends 65 per cent. for operating expenses. If these are less than 65 per cent. the saving is divided equally between the two companies. If these are more than 65 per cent., the Wisconsin Central pays them until they reach 68½ per cent., when the excess is borne equally by the two companies, provided, however, that the Northern Pacific shall not be obliged to pay at any time in excess of the profits it has received from the operation of the contract. The contract will take effect on July 1.

THE MOST SERIOUS RAILWAY ACCIDENT of the week was a head collision, May 5, on the Northern Pacific Railway, near Crystal Springs, Dak., between a passenger and a freight train. Both engines and the baggage and mail cars left the track, and several freight cars were wrecked. Two men were killed and 2 injured; none of the passengers were injured. The accident is said to have been due to a misunderstanding of train orders on the part of the operator at Steele, and the conductor and driver of the freight. The operator is accused of criminal carelessness.

A SERIOUS CROSSING ACCIDENT occurred May 8 on the Michigan Central at Kalamazoo, Mich., a switch engine running into a street car at a crossing. Six persons were killed, and two injured There were gates at the crossing, but by an inexcusable violation of good practice, if the newspaper accounts are correct, they are left unattended from 5.30 to 6.50 P. M. daily while the gateman goes to supper. The driver of the car, who was a new man seeing the gates open concluded that the gateman was off on this important business and that the road was clear. Similar accidents occur continually from the practice of leaving gates up, unattended, at night, which have a watchman in the daytime; but this is the first case we recall of gatemen going off for meals in the middle of the day. It may be questioned if gates thus attended intermittently are not a greater source of danger than no gates at all.

THE RAILWAY ACCIDENT IN CHINA, which occurred March 25, has been "worked for all it is worth" by the opponents of railways. It is described as follows in the North China *Daily News*:

The up train from Tong Sha was so much delayed that it did not leave for Tientsin, until 5 hours 20 mins. after the regular time. The down train waited until 8:30 and then continued on its way. The engineer of the up train had nearly brought his engine to a stand when the collision took place. He was thrown a distance of 20 ft. but escaped. Engineer JARVIS, of the down train, died about 2 hours after the accident. It is supposed that he was scalded to death. The carriages on the down train next to the engine were completely smashed and caught fire. Twelve native passengers and two firemen were either crushed or burned to death. No one on the up train was seriously injured.

BRIDGE AND TRESTLE ACCIDENTS are reported as follows: On April 27, a bridge on the Southern Pacific over White Oak bayou, at Houston, Tex. gave way under a freight train, most of the cars going into the water. Four men were seriously and one fatally injured.——On April 28, a bridge over an artificial lake at Chelsea Park, Kansas City, gave way under a crowd which had gathered to see a man walk on the water. The railing gave way first under the pressure of the crowd, and then the bridge itself gave way in the middle. About 80 persons were thrown into the water, but no one was killed. ——On April 30, a section of the Oconee river bridge at Milledgeville, Ga., gave way while under repair; it had been condemned as unsafe.——On May 2, a trestle on the Peoria & Pekin Union Ry., between Pekin and Hollis, Ill., gave way under a freight train.——On May 3, a freight train on the Cleveland, Lorain & Wheeling road went through a bridge at Maynard, O. No one was killed.——On May 1, the Will's creek bridge on the George's Creek & Cumberland Ry., near Corrigansville, Md., was blown down during a gale.——Several bridges on the Saguenay river between Chicoutimi and St. Alphonse, Que., have been swept away by floods.——The Rouge river highway bridge, near Springwells, Mich. broke down recently.——A wooden bridge on the Central Vermont Ry., near Braintree, Vt., was destroyed by fire a few weeks ago.

THE NEW NIAGARA BRIDGE, built to replace the one blown down in January last, was opened to travel on May 7. The bridge is 1,200 ft. long, 17 ft. wide, and is 197 ft. above the river. G. W. MCNULTY was the engineer, and the work was done by the Rochester Bridge & Iron Works Co

THE SENATE COMMITTEE ON INTERSTATE COMMERCE Senator CULLOM, of Illinois, Chairman, is holding a session in this city to investigate the competition of Canadian railways with American lines. The gentlemen who have thus far testified before the Committee are Chairman FINK of the Trunk Lines Association, Presidents KING of the Erie, and DEPEW of the New York Central, General Manager JOS. HICKSON of the Grand Trunk, Vice-President SAMUEL FELTON of the Erie, Presidents CHAS. F. ADAMS of the Union Pacific, JAS. J. HILL of the St. Paul, Minneapolis & Manitoba, and ERASTUS WIMAN, the Commercial Unionist.

The commercial interests of Boston and Portland in the East and Detroit, Chicago, Milwaukee, Duluth, St. Paul, Minneapolis, and other cities of the Northwest are up in arms against any proposition to hinder the Canadian roads from competing with American lines and cutting down rates to any extent they please; but strangely enough they seem to have taken fright without cause. The witnesses thus far examined have denied any wish to shut out the Grand Trunk from American traffic, and have merely stated their belief that if the Canadian roads are to compete for American business they should be compelled to observe the Interstate Commerce law as strictly as are the American lines. This proposition is so manifestly just that no one will be likely to venture any objection to it. Indeed the Grand Trunk managers claimed that they already observe the provisions of the law on all American business. From New York the Committee intend to go to Boston and Montreal, and thence west over the Canadian Pacific.

THE COURT MARTIAL ON MAJ. G. J. LYDECKER, U. S. Engineers, tried on charges arising out of the Washington Aqueduct tunnel frauds, has made the following sentence:

To forfeit to the United States $100 per month of his pay for nine months, and to be reprimanded in orders. The court is thus lenient in view of the evidence before it, that in spaces so confined as those above the arch in the tunnel it was almost impossible to secure thoroughly good work under the contract system imposed by law.

The sentence has been approved by the President in the following pithy order, in which he justly comments on and condemns the amazing allegation of the sentence as to possibilities with contract work. We take the liberty of putting his very proper words on this point in italics:

The proceedings, findings, and sentence are approved, and will be carried into effect. The gravamen of the offence of this officer was the neglect of a very high and important duty. It is not very important from a military standpoint whether a pecuniary loss did or did not result to the Government. But that very great loss and inconvenience have been inflicted upon the community by the delays which have resulted from the failure to discover promptly the faulty and fraudulent character of the work is apparent. *The suggestion that the strictest and most faithful supervision of the progress of such a work is powerless to detect and correct the shams which are practised by the contractors in this case is a discredit to the engineering profession and entirely inadmissible.* The sentence imposed by the court seems to have given full effect to every suggestion that might mitigate the offence.

We abstract fully elsewhere the facts as to the status of the work on which the above sentence was based.

THE SUIT over the lease of the Boston, Concord & Montreal to the Boston & Maine Co., has been settled by a decision of the New Hampshire Supreme Court. The road reverts to the Boston, Concord & Montreal Co.

THE CENTENNIAL PASSENGER TRAFFIC was by far the greatest ever known. Over 1,100,000 persons are calculated to have been brought into the city on the day of the military parade, besides the regular residents. The Brooklyn bridge alone carried 607,654 people on the three days and the Broooklyn ferries 630,000 more. The elevated railways in New York carried 765,000 on the first day and 825,000 on the second day, the usual daily traffic being now about 520,000. The Brooklyn elevated roads carried on the three days 437,000 passengers, an excess of about 125,000 over their regular traffic. The Brooklyn City Railroad Co. (horse-cars) carried 530,000 on the three days, an excess of only 30,000 to 40,000. No accidents or injuries of any moment occurred either in handling this enormous traffic or elsewhere.

A NEW COMPETITIVE ROUTE is proposed for freight shipments between Chicago and the seaboard via the Chicago, Milwaukee & St. Paul, Milwaukee & Northern, and Canadian Pacific systems. Chairman BLANCHARD of the Central Traffic Association objects very strenuously to the scheme, which he characterizes as "a proposal to take freight around three sides of a square against roads operating on the fourth and short side." General Freight Agent BIRD, of the Chicago, Milwaukee & St. Paul, says in a letter to Mr. BLANCHARD that while the proposed route may be circuitous, it is no more so than some which are in use by members of the Central Traffic Association. He states, however, that his company has not yet decided to enter the lists as a competitor of the trunk line roads, although the offer as above outlined has been made by the Canadian Pacific and the Milwaukee & Northern.

THE NORTH SEA AND BALTIC CANAL is announced as open to proposals for earthwork and excavation to the extent of 15,514,000 cu. metres. Tenders must be in by May 18, addressed to the Imperial Canal Commissioners at Kiel, Germany. The notice given was less than one month from time of first issue.

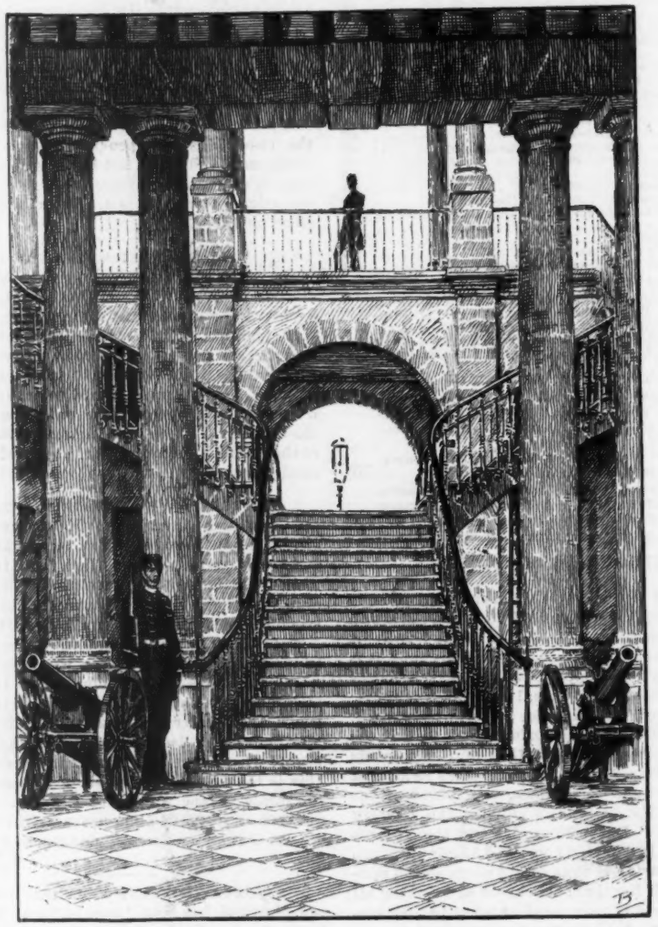
THE SUPREME COURT OF FLORIDA has rendered a most important decision regarding the power of the State Commission to fix railway rates. The Pensacola & Atlantic Ry. Co. refused to adopt the tariff ordered by the Commission on the ground that its receipts under it would not be sufficient to pay operating expenses. The Court holds that a reduction of rates to this point by either a Legislature or a Commission is a deprivation of property without due process of law, and without just compensation, and is therefore in conflict with both the Federal and the State Constitutions. The main point of interest is that the evidence put in by the company that such rates would result in the manner stated is accepted as proof; and the railroad is not obliged, as in Iowa, to carry on its business at a loss for a time to prove its case.

A CLOSER ALLIANCE between the Canadian Pacific and the St. Paul, Minneapolis & Manitoba is prophesied because of the election of Sir DONALD A. SMITH and Sir GEO. STEPHEN as directors of the latter company. It is also prophesied that the Chicago, Burlington & Quincy will join in the alliance to furnish the other systems an entrance to Chicago. As far as the first rumor is concerned, it is a well-known fact that the relations between these two companies have long been very friendly, and unless the Manitoba system should become a competitor of the Canadian Pacific by the completion of its line through to the Pacific coast, the alliance between them is likely to be made closer in the future, although actual consolidation is not at all probable. What the Burlington system could expect to gain by joining the Manitoba and Canadian Pacific is rather problematical; but perhaps it could sell the Chicago, Burlington & Northern road to the Manitoba and thus escape further responsibility for that company's escapades.

Another alliance prophesied is between the Northern Pacific and Grand Trunk. While this may be carried out eventually, it is not likely to be anything closer than a traffic agreement. As long as the two roads have to bend around the southern end of Lake Michigan to connect with each other, they can hardly be operated to any great advantage as a through line.

The Grand Stairway in the Palace of Chapultepec, Mexico.

The cut-stone work of Mexico is often very beautiful, both in design and execution, and in all Mexico, or on this continent, there is not, to our thinking, a finer or more artistic piece of work than the grand stairway we illustrate by the two accompanying views, showing, the larger one, all three of the successive flights, and the smaller one, a full front view of the lower flight and a side view of the two middle flights. We know of no other stairway like this in the world, but whether it be unique or not, the finished grace of its design and the perfection of its construction (for not a crack or sign of settlement is visible about it anywhere) reflects the highest credit upon the accomplished engineer who designed it, Col. VILLEGAS, of the Mexican Army, now Director of the Military College, of Mexico, which is located in this building, the former imperial palace.



The Grand Stairway in the Palace of Chapultepec, Mexico.

Chapultepec is a small hill of rock rising precipitously some 200 ft. from the surrounding flat ground, about 2 miles from the City of Mexico, and has been from time immemorial the imperial or viceregal residence. The hill is even supposed to be partly of artificial origin, there being some evidence that the vast mass of disjointed volcanic rock of which it consists, forming a plateau just about large enough for a single great building, and falling off abruptly on every side, was in part built up there block by block. An old cave still exists in which prisoners were confined in the days of Montezuma, entered from below, and opening in a small hole above, not a hundred feet from the grand stairway shown, and this at least must be largely artificial.

Here Montezuma and the Spanish Viceroys who succeeded him held their court, and here, after the republic was established, a fortress and a military school were given place. A great spring, starting from the foot of the rocks, supplies water to the city of Mexico through an ancient aqueduct of masonry arches. A mile or two back of it is a large stone building, a powder mill, still known as Molino del Rey (the king's mill). This was first stormed by Gen. SCOTT in 1847, and then, under cover of a feigned attack upon the city, two storming columns attacked Chapultepec from opposite sides, and carried it after brave resistance in which the cadets of the military school took an honorable part, many of them losing their lives. MAXIMILIAN, after his assumption of the crown, established his palace here, and did much to perfect and beautify the building and grounds, and the stately avenue which runs to it in an air line from Mexico. A general view of this avenue, with Chapultepec in the distance, was given in our issue of Feb. 11, 1888, in our view of the fine new statue to the memory of Quauhtemoc, the last of the Aztec emperors. After the dethronement of MAXIMILIAN the palace again became a military school, being regarded as too grand an affair for the residence of a president.

The site commands a magnificent view of the great basin called the Valley of Mexico, and of the snow-capped mountains surrounding it. The stairway illustrated is in a pavilion, exterior to the main buildings, by which the ascent is made to their level. It is therefore open on both sides, and from the gallery above the stairway almost the finest view is obtained. We may add that the grounds of Chapultepec are even more interesting than the site and the buildings, for there grow enormous cedars, exceeded only by the great trees of California in size of trunk, many of them being 15 to 20 ft. in diameter; but resembling the live oak in general form and in their heavy draping of moss on the limbs. These trees now exist *only* in the ground of Chapultepec, a single tree excepted, which has been preserved as the tree under which Cortez rallied his forces after his expulsion from Mexico on the *noche triste*.

Such a site naturally demands some architectural dignity in the buildings erected upon it, and it will be generally admitted that the stairway illustrated,

one of their most prominent details, meets every such requirement. It will be observed that every part of the stairway is pure arch work, so designed that the voussoirs of the arch constitute the risers of the stairway. A single slab of marble only, for the tread, is laid above them.

The lower part of the stairway consists of a single nearly segmental arch. We have been unable to obtain working drawings of the structure, but believe this arch has but a single center. From the landing on the crown of this arch, a light and very flat half arch springs on each side, abutting against the walls of the entrance hall. Here of course an outside buttress of some kind was necessary. This was obtained without extra construction by adjacent exterior walls abutting against the side wall, at right angles to it. The large engraving is a little imperfect in its possible suggestion that there is beneath the landing an opposing half arch of very short radius within the chamber. What by contract. Graceful as is the final result, the construction itself is not especially expensive.

Report of Board of Experts on the Washington Aqueduct Tunnel.

The following is an abstract of the report made to the Joint Special Committee of Congress by Messrs. JOSEPH M. WILSON, HENRY FLAD and FREDERIC GRAFF, the Board of Expert Engineers appointed to investigate and report upon the present condition and possible future of the Washington Aqueduct tunnel:

This board was organized on Nov. 1, 1888, and at once proceeded to make a careful personal examination of the tunnel by taking advantage of openings broken through the lining, or by sounding and drilling. The geological formation consists of micaceous schists and hornblendic rocks, with the proportions of mica, hornblende, quartz, feldspar, etc., differing widely in the length of the tunnel. Deposits formed in the tunnel at the "weep-holes" would indicate that the decomposition of the rock surrounding the work is going on rapidly. The rock varies much in its power of resistance against disintegration; and some rock which seems hard and durable will, when compressed in the hand, crumble to powder or may be worked into a soapy, clay-like substance. Seams of decomposed rock were found at many points during construction, and the Board of Experts think that some of the rock which now appears perfectly solid will decompose. The rock cleavage is very irregular, and it is impossible to blast closely to the normal section; as a consequence, many spaces were left to be filled with backing.

The tunnel lining consists of two side walls of brick or stone and a semicircular brick arch, with a brick invert added for a considerable length. The amount of each kind of lining is as follows:

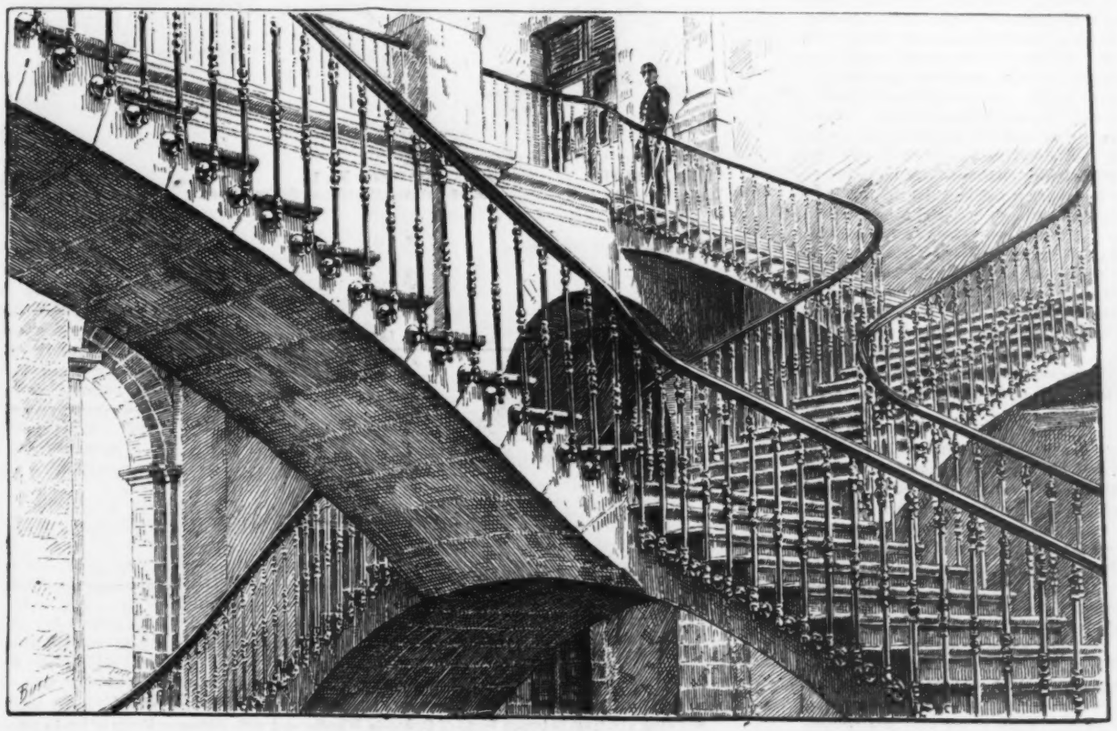
	Feet
Rubble masonry side walls, no invert, rubble masonry back filling	5,929.8
Brick side walls, no invert, rubble masonry back filling	1,270.5
Brick side walls, brick invert, rubble masonry back filling	5,849.14
Brick side walls, brick invert, dry-stone back filling	1,717.56
	14,767.00
Unlined	5,929.30
Total length of tunnel	20,696.30

As a general rule, when the side walls were built of rubble, the arch consists of two-ring work. Where the excavation was particularly bad, three and four ring arch-work is indicated on the profile.

From surface examination of the brick-work, it appeared to be of substantial character, with joints well filled, cement mortar tolerably fair, and workmanship good. Holes cut in the work east of Champlain Shaft confirmed the good character of the brick-work and cement; but west of that shaft, the brick-work was not nearly so good. In some places where three and four rings were used in the arch, the bricks in the upper ring were laid without mortar and could be lifted out by the hand; in other cases, only the first ring was properly laid. East of Rock Creek Shaft, the brick arch was also bad, and very bad work was found in other parts of the tunnel. The rubble work in the side walls, as far as exposed, was well built.

The contract and specifications called for different kinds of backing, one of broken stone packed solidly, and the other of "rubble laid in cement mortar." The dry filling was not packed as required by the specifications, but was generally dumped into the open spaces back of the facework, so as to leave cavities. In the rubble masonry laid in cement mortar for backing, the experts found no work to accord with the specifications. What backing was found consisted of dry work, with here and there a lot of cement mortar dashed in among the stones.

The question of how best to test the work for the detection of cavities behind the arch-work was thoroughly discussed by the Board, and after a visit to the New York aqueduct, where a very similar examination was going on, the experts adopted the steel rod method of sounding, there used. A man experienced in work of this nature, and perfectly trustworthy, was also secured from the New York work. The soundings were taken with the steel rod every 5 ft., and 415 openings were cut in the brick-work wherever the soundings rendered it desirable. A careful record was kept of the results of these cuttings and are given at length in the report. Some of the cavities found had the following dimensions: One 188 ft. long 5 to 13 ft. wide and 2 to 8 ft. high; another 71 ft. long by 4½ to 12½ ft. wide and 2 to 7 ft. high; another 56 ft. long, 6 to 10 ft. wide, and 2 to 6 ft. high; another 113½ ft. long, 6 to 16 ft. wide, and 3 to 10 ft. high, etc. The greatest number of serious cavities seems to have been found



The Grand Stairway in the Palace of Chapultepec, Mexico.
Col. VILLEGAS, Director of the Military College, Engineer.

there really is, is merely a stone of a little darker color, in the wall under the nearly flat upper part of the intrados, which abuts squarely against the vertical wall.

From these two upper landings, two third flights spring on each side abutting against the upper floor, and obtaining from it an abutment of sufficient resistance without any great amount of additional construction, as will be clear from the drawings.

The flat arch over the foot of the stairway which supports the floor above, is also worthy of note as an excellent detail. The stone used is a kind of light colored porphyry, known locally as *chiltna*, which is comparatively light, but has great strength. The stairway was tested in every possible way after construction by a battalion of soldiers, and neither then nor since has any sign of weakness appeared. To the eye the whole stairway seems to be of marble. The balustrade is of brass throughout, and, except that the corners are rather awkwardly turned, and need reconstruction, constitutes an excellent finish in keeping with the lightness of the structure.

The general idea of this design is capable of utilization in many structures for water-works, parks, and railways which are chiefly of stone and demand a certain dignity of treatment; but it would be just as well, probably, in attempting such construction, to execute it by day's work, and not

west of the Howard Shaft and west of Champlain Avenue Shaft.

The general method of the contractors in carrying out this fraudulent work was, to roughly fill in back of the haunches, without any attempt at laying or packing the filling, and to leave the space above the arch open. Dry masonry cross-walls or piles of stone were built at intervals of 10 to 18 or 20 ft., and plastered over the face with cement to deceive the inspectors.

The Board of Experts examined carefully into the question of the permeability of brick work, and as to whether the tunnel, if it had been built according to contract, would be entirely adequate to retain the water in the tunnel. The Board was of the opinion that where the back-filling was dry-stone, the tunnel could not possibly fulfil this condition of conveying water under pressure. If all the work was faithfully back-filled by masonry laid in cement mortar, the tunnel could be made reasonably watertight, but even this would not prevent all leakage, and it is difficult to foretell how much water would pass through. The Board was guided in this opinion by tests made by them upon the permeability of brick masonry, and by the previous experience of other engineers. The experiments made by them, under a water-pressure of 80 lbs. per sq. in. applied for one hour on a good, fair specimen of the brick used in the tunnel, showed that in this time 23.4 cu. ins. of water in the first trial and 21.3 cu. ins. in the second trial passed through the brick. The average of these two trials was equivalent to 1.75 galls per sq. ft. of surface per hour, or for the whole interior of the tunnel a leakage of 27,342,000 galls. in 24 hours. Blocks of cement mortar, made one cement and two sand, were prepared, allowed to set 24 hours in the air, and then placed under water for five weeks. These blocks, when tested under 80 lbs. water pressure, passed the water at the rate of 73.8 galls per sq. ft. per hour, an amount very far beyond that of brick.

In estimating the cost of making the tunnel as reliable and safe as possible, as requested by the Committee, the Board of Experts recommended that all unlined portions of the tunnel, be lined with brick masonry and backed by rubble masonry laid in cement, or with concrete; that an invert be placed in all parts of the tunnel, and that all defective masonry be replaced. Grouting with Portland cement pumped through holes drilled in the brickwork was recommended for all small spaces outside the arch, and for spaces under 2 ft. high a packing of dry stone and this same grouting. For larger cavities, rubble masonry laid in cement mortar by days' work was deemed best, and then the work was to be carried out under the most rigid inspection of work and materials. With 10 per cent. for contingencies, the estimate for this thorough repair of the tunnel amounted to $929,720. If the original contractors can be made to rebuild all defective work, the expense to the Government of completing the tunnel according to the plans and specifications of July 1, 1888, would be $190,850.

Even with the work properly completed on the original plans laid down, the experts believe that the danger to private property would still be very great. This danger would come from leakage of water through the 1717 lineal feet of dry lining in the tunnel and from the lengths where the invert was omitted.

In view of the great cost of reconstructing the tunnel, and in consideration of the fact that even if the work is well done some element of danger would still remain, the Board hardly feel justified in recommending the reconstruction. The Board believes the tunnel might be made useful by fitting it up as a passageway in which to lay a large wrought-iron or steel main, and they find that a 6-ft. pipe will carry 33,000,000 galls. per day. The experts propose a pipe of mild steel one-half inch in thickness, 6 ft. in diameter, and connected at frequent intervals by U-joints to allow for changes in temperature. This pipe would be supported on cast-iron saddles at short intervals set in cement. The estimated cost of this 21,000 lin. ft. of 6-ft. steel main, with gate-houses, valve-gates, setting, etc., is put down at $852,786. An equivalent length of three 4-ft. cast-iron mains, with pipe laid on the surface and under Rock creek, would cost $1,178,650. One main of this diameter would carry 11,000,000 galls. per day under the 1.86 ft. difference in head between the two reservoirs. One cast-iron main could be laid at a cost of $598,000, which would at once improve the distribution on the high ground about Capitol Hill. The new reservoir was also examined, and the experts report that it seems to them that all usual precautions have been observed and the work faithfully done, and there is no reason to fear leakage.

As to the question of a gravity conduit submitted to the experts, the Board report in substance as follows:—No instrumental survey has been made for this special purpose, but the ground was personally examined in connection with a contour map furnished by the War Department, and a conduit line was laid down, as far as practicable on the line of streets. The conduit would be 22,350 ft. long, with 8,800 ft. in tunnel worked from open cuts. The capacity would be 35,000,000 galls. daily and the requisite section would be 32.5 sq. ft. This would give a section 7 ft. wide by 6 ft. high, with vertical sides, semicircular arch, and invert bottom. It would be built of brick with a granitoid bottom, 3 ins. thick, or some equivalent smooth material.

Rock creek and Foundry Branch ravines would be crossed by aqueduct bridges at the hydraulic grade line; the first would be 1,600 ft. and the latter 1,300 ft. long, including approaches. They would be stone arch structures, with six segmental arches of 100-ft. span each over Rock creek beside the approach arches. Another plan proposes to cross these streams by one 6-ft. steel or three 48-in. cast-iron siphon pipes, supported on masonry arch-work over the streams. The estimated cost of these several gravity plans is as follows:

Design No. 1.—Gravity conduit, aqueducts on hydraulic grade line, complete	$1,805,870
Design No. 2.—Gravity conduit, 6-ft. steel siphon pipe	$1,465,200
Design No. 2a.—Same, with three 4-ft. cast iron siphons	$1,567,170
Design No. 2b.—Same, with 6-ft. steel siphon pipe and modifications	$1,345,740
Design No. 2c.—Same, with three cast-iron siphons and modifications	$1,419,880
Gravity conduit with three cast-iron 4-ft. siphons crossing streams without bridges	$1,247,092

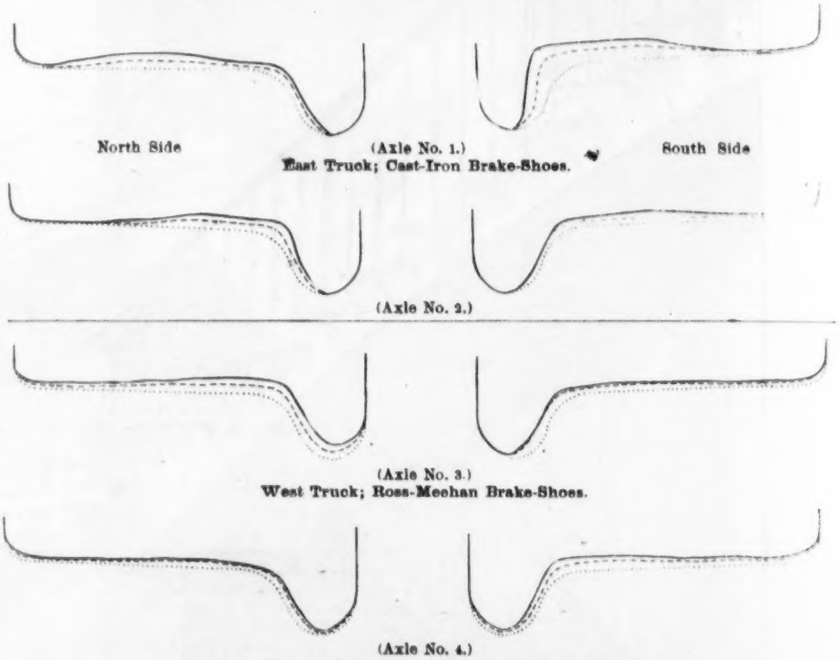
The estimated time for completion of a gravity conduit is from two to three years according to the plan adopted.

THE KANSAS CITY & INDEPENDENCE RAPID TRANSIT CO. has, through its stockholders, voted to issue $1,000,000 bonds for improvement in road-bed and equipment. The road will be double-tracked throughout, and seven new motors and sixteen cars are under contract. Trains are now run every half-hour, and about the middle of the month the interval will be reduced to fifteen minutes.

Test of Wear of Tires.

The cross-sections given in the accompanying cuts show the results of a test on baggage and mail car No. 302 Michigan Central Railway, and furnish cumulative evidence of the real cause of sharp flanges, as well as of the merits of different shoes, for which purposes, no doubt, they were primarily taken. The car went into service July 1, 1887, with all wheels (42-in. steel-tired) turned to the standard, as shown by the lower dotted lines of each cross-section. On Oct. 4, 1887, after 31,220 miles run, the outlines shown by the middle dotted lines were taken, and on Jan. 7, 1888, the test was completed, and the upper solid lines were traced, the car having run 24,360 miles since Oct. 14, and a total of 55,580 miles from July 1. The Mackenzie tire-indicator was used in taking the sections.

We are indebted for the sections to MR. WM. D. SARGENT, Superintendent of the Congdon Brake Shoe Co., of Chicago, Ill., who writes us:



Test of Wear of Tires; Michigan Central Railway.

Showing Contrast between Wear of Opposite Wheels and with Different Kinds of Brake-Shoes.

I send you blue-print herewith by same mail, showing results of a test on the Michigan Central Railroad, thinking it may throw some light on the question of flange wear.

This tracing was made from the original cards, taken by the writer, and is an exact copy. I also enclose report of a test on Mann boudoir cars.

It will be seen, by comparing the opposite tire sections on axles Nos. 1 and 2, that in each case one wheel tended to run sharply to flange, and the other to wear rather away from flange. Axles Nos. 3 and 4 had the Ross-Meehan brake-shoe fitted to them, which is expressly designed to prevent wheels from wearing in flange by concentrating the brake-shoe wear on the top and sides of the flange and back side of the tread, where the wear due to rail is least. Its results, as might be expected, that the wear on the tires is much more uniform; but then it also results, in this case at least, that no sharp flanges were produced. It is evident that wherever inequality of wear like that on axles 1 and 2 begins, it tends to continue at an increasing rate because of the unequal diameters which result. It is not to be expected that any form of brake shoe can entirely prevent this tendency, or the formation of sharp flanges; but that a brake shoe tending to cause equal wear on all parts of the wheel should modify and ameliorate the tendency to sharp flanges is evident.

The form of the Ross-Meehan brake-shoe is shown in the accompanying illustration. The bearing is exclusively around the flange and on the back of the tread, there being a hollow where the wheel wear comes. These particular brake-shoes were on the Congdon principle also, small bits of scrap

wrought-iron being imbedded in the casting, which has been found to increase both the life and efficiency of the shoe. That construction has no necessary connection with the Ross principle of equalizing wear, but has been found to increase the life of the shoe in about the ratio of 2½ to 1 for equal weights, or of nearly 4 to 1 for 48-lb. shoes as com

The Ross-Meehan Brake-Shoe.

pared with 28 lbs. of the common cast-iron pattern, or 7,763 miles per shoe against about 2,000 miles. The costs per pound are about 2½ cts. for common shoes and 4½ cts. for the Ross-Meehan shoes. It was found in one test under Mann boudoir cars that the average mileage of tires between turnings was 30,000 for common shoes and 150,000 for the improved shoes. While these precise figures may vary, the sections we give will show that there should naturally be a very considerable difference.

Test Borings by Hand Labor.

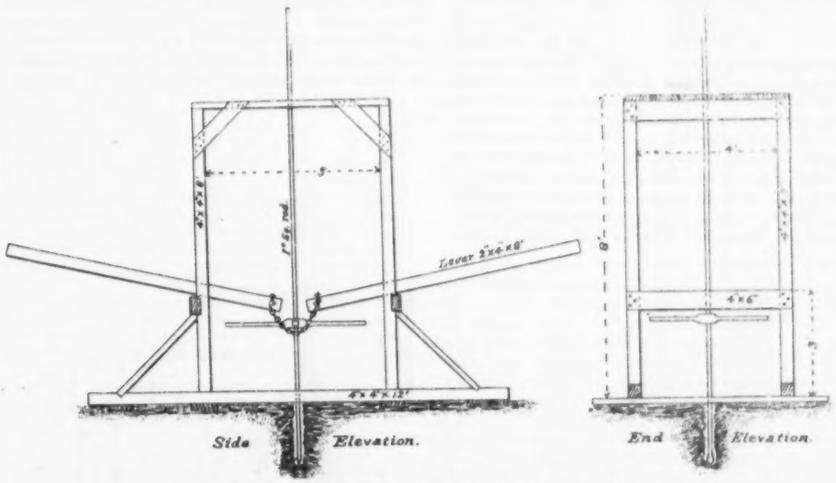
An engineer often has to make borings at a moderate depth to determine the length of piling necessary for certain work, or to ascertain if there be rock at no great depth below the surface, or to learn the exact nature of the sub-stratas of earth 20 or 30 ft. below the surface. In such cases machine boring is not always available, or too expensive to be employed, and more often the engineer is not furnished with the money necessary to pay for machine boring, and must extract the desired information from the earth by exercising his own ingenuity, and apply the best means at hand for the purpose. A hand-boring apparatus has been used satisfactorily by W. F. GOODHUE, C. E., of Milwaukee, Wis., who sends us the following illustration and description:

The whole apparatus will not cost more than $25., and it can be readily made wherever a lumber yard and blacksmith shop exists. Of course it is not expected that a simple apparatus of this kind can be used for boring through rock strata, but it will bore through earth of any kind to a depth of 28 or 30 ft.; beyond this depth it is difficult to handle the drill-rod, and the strains are too great upon the set screw and lifting pins, hereinafter described, causing them to break or bend double. Unless the soil is very favorable for hand boring, it should be discontinued at a depth of 30 ft., and machine boring employed.

For a hand drill use an iron rod, one inch square, never use a round rod. The square rod penetrates more easily than a round rod, is more easily raised for cleaning because there is less suction, there being four vacant spaces between the flat sides of the rod and the periphery of the hole in which the rod is working. A round rod fills, or rather plugs, the hole so effectually that it is sometimes nearly impossible to raise it with all the muscle available. The point of the rod should be made chisel shape, that is, with a flare upon each edge, making the chisel about three-eighths of an inch wider than the rod itself. By this means the hole is made a little larger than the rod, which latter is thereby more easily drawn, especially if boring into a strata of wet, blue clay.

The upper half of the rod, if it be 18 or 24 ft. long, should be drilled with three-eighth-inch holes about every 20 ins. for inserting an iron pin to hold the chain when lifting it. This pin should be about 3 ins. long, and made a trifle smaller than the holes, that it may be inserted therein when desired. The pin should have an eye forged upon one end and a billet of wood attached to it with stout cord, for there is great liability of the chain suddenly slipping off and the pin dropping into the hole, especially if the men at the levers commence "jerking" too violently to start the rod upwards. It is well to make at the outset an extra pin and set screw for the iron cross-arm, for the wear on both is great if the boring is deep and the earth very firm.

The iron cross-bar should be made of bar iron 1¼ ins. square and 4 ft. long, reinforced at the eye (where the drill-rod passes through it) with 1 in. of iron all around, for there is considerable strength



A Cheap and Effective Test Boring Outfit.

required at this place when boring through gravel at a depth of 14 or 18 ft. Tap one side of the eye for a set screw, at least three-fourths of an inch in diameter, to hold the cross-bar to the rod. The chain used should be not less than a three-eighth-inch link, although the writer has recently used a new chain, one-fourth-inch link, and had but one break.

There are two ways of jointing the drill-rod: one is to weld the joint, but this method makes a very unwieldy rod to handle; another way is to tap the upper rod and thread the lower rod, then tap the rod transversely with a tap three-sixteenths diameter and insert a soft iron pin, bushing the ends to hold it in place. It can be easily driven out when desired. By tapping the upper rod and threading the lower, it is much easier to make a connection again should they become separated below ground, as they sometimes will when the man at the cross arm twists the rod for a great length of time in one direction. The platform on the top of the drill frame is very useful for the men to stand upon and assist those below in jointing and handling the rod. A hole, 2 ins. in diameter, bored through the platform directly over the boring in the earth, will serve to guide the rod when it is being handled at its extreme length. The inside plank, of which the platform is made, should be held with one nail in each end, so that any one of them can be removed easily, for they sometimes interfere with the handling of the rod and have to be removed.

If the rod lifts with difficulty, use two levers to raise it, then it can be lifted vertically; one lever will cause the rod to bend badly, and it then is even more difficult to raise. Use plenty of water for puddling the hole, if there be none in the ground. Three men can use the apparatus easily, and bore to the extreme depth herein mentioned.

A "SINK-HOLE" near Howell, Mich., on the line of the Toledo & Ann Arbor road, interfered with traffic for some time last week. Such sink-holes are very common all over southern Michigan, old lakes being skimmed over with a coating of soil, and even heavy forests, while there is nothing but water underneath.

Operations of the Pennsylvania Railroad.

The annual report of General Manager CHAS. E PUGH gives the following details of operation of the Pennsylvania Railroad system for the calender year 1888:

The increase in operating expenses of $1,198,002, equal to 5 per cent. above this item in 1887, was due to increased expenses in the following sums: Transportation $730,027; motive power, $375,518; maintenance of cars, $500,957; general expenses, $5,583—maintenance of way expenses decreased $426,044, or 8.76 per cent. Labor and wages, telegraph expenses and State taxes, account for the increase in transportation department expenses.

It cost 64.4 per cent. of its gross earnings to operate the main line, excluding branches, and 64.11 per cent. including branches, against 63.39 and 63.24 per cent. respectively in 1887.

For repairs and renewals, 16,108 tons of steel rails and 730,826 cross-ties, and for construction, 6,686 tons of steel rails and 232,694 cross-ties, were used in adding 165 miles of single track for new branch roads and construction and extension of second, third, and fourth tracks and sidings. New systems of interlocking switches and signals were erected at about fifteen important points. Extensive improvements, made in carrying out the policy of building stone and brick arches to supersede iron bridges are detailed at considerable length.

On the United Railroads of New Jersey Division, 18 miles of additional tracks and sidings were laid, making a total single track mileage of 1,061 miles. On the New York Division several changes to abolish grade crossings in this city and elsewhere are noted. On the Amboy and Belvidere Divisions there was much needed new bridge building. Special mention is made of the construction of the Cambria & Clearfield Railroad, from La Jose on the Clearfield & Jefferson Road to Brubaker Junction, an important link opened September 24. On the Middle Division new third and fourth track was laid for some distances. At Altoona new track was laid to facilitate the movement of passenger trains and to accommodate eastward freight traffic, and on the Pittsburg Division additional third track connections and engineering work to dispense with bad curves was completed. From branch intersection to Steelton the road was entirely reconstructed. At Middletown the Union Canal was filled in, the bridge being replaced by solid embankment. On the Philadelphia and Erie, 10 miles of new track and company sidings were laid, making 539 miles of single track.

There are 1,450 locomotives in the equipment, against 1,349 in 1887; freight cars, 30,782, against 28,296 in 1887. Of the additional cars, 2,500 became company property through the payment of Pennsylvania Car Trust certificates, series C, D, and E. Besides the above cars there are 28,842 freight cars in service owned by companies and individuals, and 652 coal dumps are not included in the foregoing. The floating equipment includes 158 vessels.

At the Altoona shops 128 locomotives, 45 passenger cars, 2,547 freight cars and 34 maintenance of way cars were built, and at West Philadelphia 5 passenger, 7 baggage, and 6 cabin cars, 13 coal wharf dumps and 2 Victoria cabs were built. At the Wilmington shops 8 locomotives and 50 stock cars were built, and private firms built 42 locomotives. The Altoona wheel foundry increased the wheels by 8,065, or 8 per cent., and the iron foundry made 15,329 tons of castings.

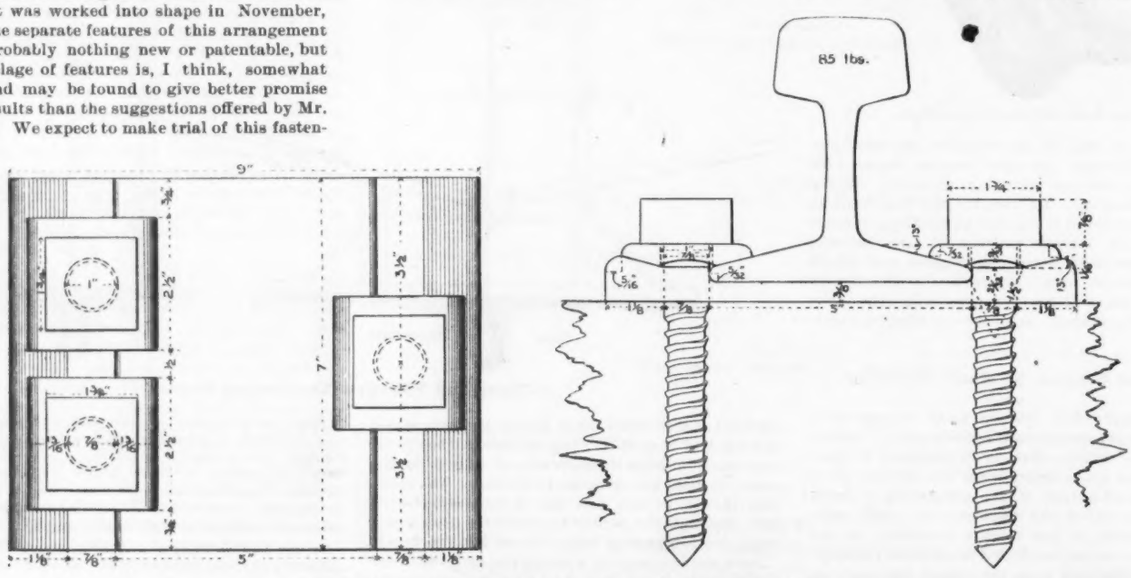
The total locomotive mileage was 42,618,314 miles, an increase of 6.7 per cent.; freight locomotive mileage increased 2,191,548 miles, or 8.4 per cent.; passenger increased 611,679 miles, or 4.9 per cent.; distributing decreased 141,991

miles, or 10.7 per cent. One freight locomotive made 50,772 miles, and the average passenger and freight locomotives on the Pennsylvania Railroad Division made 33,403 and 27,966 miles respectively. Repairs, fuel, and stoves cost $5,986,064, an increase of $381,221, and an average cost per 100 miles of $14.05.

For the Northern Central Railway, of which Mr. PUGH is also General Manager, he reports: For repairs and renewals, steel rails, 1,991 tons; cross-ties, 192,729; new single track 5.28 miles, making a total of 668.17 miles. This new track was mostly for sidings. The freight cars number 5,658, an increase of 136 new and improved rolling stock.

New Rail Fastening and Tie Plate, Pennsylvania Railroad.

Mr. M. W. THOMSON, Engineer of Maintenance of Way, Pennsylvania Railroad, sends us, in discussion of Mr. TRATMAN's paper on "The Improvement of Railway Track," published in abstract in our issue of April 27, some particulars of a new rail fastening, herewith illustrated, which is to be tried on that road. Mr. THOMSON says: "Of late we have been giving not a little thought to the necessity of fastening our rails more securely to the ties, and in this connection I beg leave to enclose herewith a plan that was worked into shape in November, 1888. In the separate features of this arrangement there is probably nothing new or patentable, but the assemblage of features is, I think, somewhat original, and may be found to give better promise of good results than the suggestions offered by Mr. SANDBERG. We expect to make trial of this fastening very shortly, and our present thought is to use only four plates to each length of rail. The cost will thus be brought within reasonable bounds, and their usefulness can be as well determined on that basis as by using a larger number to the rail. The base plates and washers can be rolled in long bars and sheared to lengths. There is certainly growing need of a better fastening than the ordinary spike, and it might be well to give a cut of this, so that other minds may be led to work in that direction."



Tie Plate and Rail Fastening: Pennsylvania Railroad.

The accompanying cuts show clearly the character of the improved fastening, which is somewhat similar to that adopted by Mr. SANDBERG for the 110-lb. rails on the Belgian State Railways (ENGINEERING NEWS, May 21, 1887). The base plate is 7 ins. by 9 ins., with a rib along each side, forming a channel for the flange of the rail. Three screws are used, and they hold the rail by means of washers, as shown. The fastening is in the line of the suggestion made by Mr. TRATMAN in his paper on "English Railroad Track" (Trans. Am. Soc. C. E., June, 1888) as by many others before and since, that the use of bed plates would increase the efficiency of a flange rail track, and that with a screw fastening it would be better to use a washer to hold the rail flange than for the head of the screw to bear directly on the flange, as in Mr. SANDBERG's fastening. We are pleased to learn that this new fastening is to be tried, and do not doubt that it will give favorable results. It is to be hoped that it will lead to a still more active movement for abandoning reliance on spike fastenings only, for main tracks at least.

Fresh Water Algæ and Their Relation to the Purity of Water Supply.

At the last meeting of the American Society of Civil Engineers, Mr. GEORGE W. RAFTER, M. Am. Soc. C. E., read a valuable but lengthy paper upon the above subject, from which we make the following brief abstract. The paper is to be discussed at the meeting on May 15.

The quite general impression that the tastes and odors found in different water supplies were limited in number, and that the grass-green varieties of algæ were entirely innocent, was first shown to be erroneous, and the experience of the author led him to say that some of the grass-green algæ were especially virulent as found in testing as least 200 species of algæ.

Algæ are in the fullest sense hardy plants, many of them growing vigorously in winter, and specimens of the *Microcoleus*, an alga related to the *Nostoc*, were found in Hemlock Lake, near Rochester, N. Y., on Feb. 20, last, with ice on the lake 12 to 15 ins. thick. In Livingston Co., N. Y., a vigorously germinating alga was found mingled with melting snow. The algæ of Nova Zembla number 172 fresh water species, belonging to 57 genera. *Chlamydococus pluvialis*, the red snow of the arctic regions, is plentiful even in New York and Pennsylvania.

While many species of algæ are thus shown to be hardy, it is equally sure that some of them at certain stages of their development are extremely sensitive to changes of temperature.

Certain other species only live in waters containing some particular substance in solution, as, for instance, *Beggiatoa* in waters containing sulphur in some form, *Batrachospermum moniliforme* in rapid running limestone waters, while some species of *Inactis* are at home only in sandstone waters. *Cladophora* and *Vaucheria* are primarily marine forms, and it is doubtful if the fresh-water varieties will continue to exist in a water absolutely free of sodium chloride in solution.

In investigating the grass-green varieties, recent studies indicate that the bad tastes and odors coming from them are entirely independent of color. The real cause of the trouble must be looked for in the jelly, starch, oil, or sulphur producing capacity of the plant. The intensity of result will also be indicated by the vigor of development and the quantity present in any given case. Mr. RAFTER advances the following working theory to account for these various odors and tastes:

It is well known that certain algæ contain more or less in quantity of starch grains in the chlorophyl granules. *Cladophora* is particularly noted in this respect, and the author, commencing an extended study of this alga, found that after standing undisturbed for several days in his laboratory, the specimens gave out an almost unbearable stench. A solution of starch and water under similar conditions gave off a similar odor, and the result of these experiments led Mr. RAFTER to conclude that all chlorophylaceous algæ are likely to develop an unpleasant odor in decay. The *Vaucheria* is noted among algæ for secreting globules of oil, and the V. *sessilis* has this development of oil drops especially marked. Mr. A. FTELEY's statement that addition of common salt to water possessing the cucumber taste will sometimes develop an oily flavor, is doubtless correct, as the action of the salt is to make the oil more perceptible to the taste.

There are, however, a large number of species of algæ which have neither starch grains nor oil globules in their structure, and these are the species which are generally credited with causing all the trouble. A number of them belong in the class *Cyanophyceæ* and the order *Schitzosporeæ*, including among such *Nostoc*, *Clathrocystis*, *Cœlosphærium*, *Lyngbya* and others. A number of the cryptograms of this class and order are enclosed in a material jelly, a typical form of which is well illustrated by *Nostoc*. We have, however, *Batrachospermum*, in which the jelly mass is an integral part of the development, in the class *Rhodophyceæ*, while among the class *Chlorophyceæ* and in the order *Confervoideæ* may be found *Draparnaldia* and *Chætophora*. Also in the order *Protococcoideæ* we find *Volvox*, *Eudorina*, *Pandorina*, *Hydrodictyon* and *Palmela*. All of these are likely, by reason either of the jelly matrix or the gelatinous structure, to give rise, when they develop in quantity, to objectionable tastes and odors in water supplies.

Mr. RAFTER thought that the ground taken by earlier students, that the diatoms never cause trouble, must now be modified. These little cryptograms, though possessing an incombustible silicious frustule, have not only a thick gelatinous enveloping membrane, but they also produce starch. Diatoms gathered on the shores of Hemlock Lake last summer gave a vile pig-pen odor even when freshly gathered. Mr. J. NELSON TUBBS, M. Am. Soc. C. E., noted several years ago that while the water in the lake was unaffected, the decay of the protoplasmic part of the diatoms on the beach created an odor perceptible for several hundred feet from the lake. Mr. J. D. HYATT has also described the extraordinary development of the common diatom, the *Meridion circulare*, on the Croton river in 1881. The unpleasant taste of the New York water supply at that time was ascribed to this cause.

As far as known, the desmids have never been the cause of any trouble in public water supplies. This is chiefly because they are less liable to sporadic growth than diatoms and filamentous algæ; they, however, possess characteristics that would lead to evil results if they developed in sufficient quantity, as they are more or less gelatinous.

It has been assumed that ground water systems of water supply must be entirely free from all trouble due to organic life. This claim is fallacious, however, as was proven in Berlin in 1877. There the water was taken from a series of covered wells near the Tegel Lake. This water became offensive, and on standing became turbid and deposited a yellow sediment consisting of oxide of iron, amorphous matter, and what proved on examination to be an alga. This alga was called the *Crenothrix Kuhniana*, it having been discovered by Prof. KUHN in Silesian farm drains. In decay this plant gave off very offensive odors and tastes, and it was found in the reservoirs, force mains, and distribution pipes in various stages of development and decay. The spores are from $\frac{1}{25000}$ to $\frac{1}{10000}$ inches in diameter, and finally attain the condition of long filaments, at first transparent and colorless, but finally becoming olive or brown by absorption of iron. Investigation proved that this alga developed and passed through its various stages in the ground itself, and in some cases the plant was found 75 ft. below the surface. Lime is said to destroy it, though it endured a temperature of 11° Fahr. and, after being frozen several weeks, revived and develoeped new plants.

Mr. RAFTER then recites at some length the trouble with the water supply of Jamestown, N. Y., which was examined by Mr. KUICHLING, M. Am. Soc. C. E., and specimens finally submitted to the author who found the *Crenothrix* alga. Mr. RAFTER compliments Mr. KUICHLING upon the suggestion that this particular alga was present, though from lack of sufficiently powerful glasses he was unable to detect it himself. There was no absolute proof, however, that the *Crenothrix* came from the driven wells, as the water passed through a swamp in a rather loosely constructed wooden conduit, and it may have taken up the algæ on the way to the consumer.

Volvox may be described as a transparent sphere from one-fiftieth to one-eightieth of an inch in diameter, the inner surface of which is studded with groups of dark green points regularly disposed, and so arranged that each group of points is the center of a symmetrical group of six others. These green points are called gonidia, and each one is probably capable of becoming a perfect *Volvox*, though in fact only a small number of the many hundred with which every perfect specimen is endowed do actually so develop. If we consider, however, that under favorable conditions their growth is comparatively rapid, a mature individual developing from the embryo in a very few hours, and in its turn giving birth to a new colony, each of which sends forth its progeny, we are led to understand how large a body of water apparently entirely destitute of *Volvox* may in a few days be made to teem with it. It was this species that troubled the water supply of Rochester, N. Y., in 1888. It was found in the distributing mains in vast quantities, though for two years previously the *Volvox* had never been noticed in the water supply of that city. It was not found in Hemlock lake to any extent at a time when both reservoirs were teeming with it. The approach of cold weather killed the algæ, and with it the objectionable taste and smell disappeared.

With the late Prof. WM. RIPLEY NICHOLS the author believed that algæ are not an unmitigated evil. They are purifying agents, changing at least a part of the dissolved organic matter into insoluable substances which settle to the bottom, and the nitrogen largely consumed in their development is obtained from the nitrates and ammonia contained in the water. Their presence is a danger signal in many cases that ought not to be disregarded.

THE LATE THOMAS J. POTTER is to be commemorated by the erection of a hospital for railway men, instead of by a monument as was at first proposed. The erection of such a hospital was one of Mr. POTTER'S favorite schemes, and it seems a most appropriate tribute to his memory. Among those in charge of the work of raising the $25,000 which it is desired to secure are E. L. LOMAX, of Omaha, G. P. A. of the Union Pacific; and C. M. LEVEY, Keokuk, Ia., Supt. of the St. Louis, Keokuk & Northwestern.

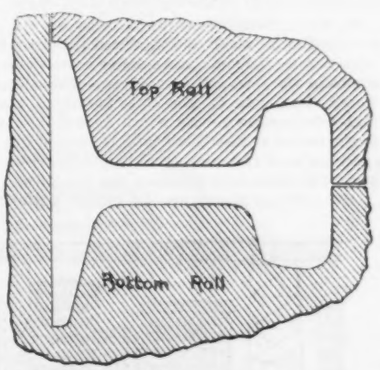
Cylindrical Wheels and Flat-Topped Rails for Railways.

We have been favored by Mr. C. P. SANDBERG with a copy of his discussion of Mr. DON J. WHITTEMORES paper on the above subject, which contains some points which will be read with interest, and in the main strike us as sound.

In his discussion, Mr. SANDBERG first refers to his own paper, just published by the Institution of Civil Engineers, on the use of heavier rails, in which it is said that his Goliath rail, adopted on the Belgian State Railways, is laid perpendicularly instead of on a cant, and he adds that this was done at the recommendation of the Engineer-in-Chief of the Rolling Stock, Mr. BELPAIRE, who actually favors cylindrical wheels; but with the large rolling stock of the Belgian State Railways, conversion would take some time. Mr. SANDBERG continues:

I am not aware that the conversion has even been begun, and nowhere else do I know of cylindrical wheels or flat-top rail being used in Europe, but they get flat enough in time, and I shall have no difficulty in proving why rails are not made flat from the commencement.

First, *from the producer's point of view*. Any one who is acquainted with the manufacture of rails will agree that the flat-top rail necessitates less pressure or work in the last groove than a round-top rail, and the more round it is, the more pressure or work or closer grain in the head will be the result. The joint of top and bottom rolls being in the middle of the head, with a small opening, if the pressure of work is excessive, it would leave a seam along the head in the joint between the top and bottom roll. Besides, the more round the head of the section is, the better delivery does the rail have from the rolls, or the less number of wasters. Thus it follows that the flat-topped rail would have a more porous head than the round one, and more wasters; and as a very short time in the track will make it flat enough, it would be an absolute loss, both to the consumer and the producer, to start with the flat-top. See drawing attached.



Form of Rolls for Rail Section of N. O., M. & C. Ry.

Again, *from the consumer's point of view*. The flat top rail can never be laid in a track absolutely correctly, so as to have the tire of the wheel bear on all parts of the flat surface, but it will bear on the left-hand corner on one rail, and on the right-hand corner on the next, and after a few trains have passed, the line will look like a snake; therefore, the evil from the round-topped rail of small bearing surface would be still worse in practice on the flat-topped rail before it is worn down sufficiently to bear on the neighboring rails alike. Thus, in practice, Mr. WHITTEMORE'S suggested remedy would bring matters from bad to worse, *both for makers and engineers*.

Now as regards the radius. I have kept to a simple radius of 6 ins. for the above reasons, but I am perfectly agreeable to an increase to 10 or 12 ins., since steel rolls so much better than iron, and the delivery would be good enough with even 12 ins. After all, it is of very little importance whether it is a 6, 10, or 12 in. radius *as long as the top is not flat*, and Mr. WHITTEMORE'S prediction that my sections would be a thing of the past is entirely premature; for I believe his flat-topped rail will never become a standard section, notwithstanding the elaborate theories of German professors and his own poetry. Besides, the thing is not new.

I enclose herewith a section which I had to inspect in 1869 at the Dowlais Works, for the New Orleans & Chattanooga Railway, 20 years ago. It was rolled in iron, 16,000 tons, and I well remember the heavy rejection we had on account of the flatness of the rail top. I am very glad to say that I never had one like it afterwards. I am sure no one could have wished more than I that the complaints generally heard now that the rails are not as good as those made twenty years ago could have been met by such a trifling alteration in the section as making the top flat, but I think the above facts show the reason why that will not do it, but simply make matters worse. The increased pressure of the heavier engines necessitates harder steel both physically and chemically, and in this direction a cure must be looked for. Now, as the physical hardness, or what is produced by cold rolling (the same as by cold hammering), is not obtainable in the fast-going mills used at the present day, chemical hardness or excess of carbon must be looked to as the simplest remedy; and as such hardness involves greater liabilities to fracture, it shows an absolute necessity of increasing the weight and the section at the same time as the hardness, if accidents from broken rails are to be avoided. This has been the motive of designing my Goliath rail, and my work in this direction. I am very glad to see that it is coming in fast on both sides of the Atlantic. Fortunately the price of steel is being gradually reduced to facilitate such a change of practice.

It is contemplated that the International Railway Association will take up the question at a coming meeting in Paris in September, and it would then be highly valuable if some of the leading American engineers would give the latest facts on the subject of increasing the hardness and weight of rails on American railways.

Mr. WHITTEMORE'S paper having been reproduced and so ably dealt with in the ENGINEERING NEWS, I have nothing more to add to what is there said, except that I believe that it would lead to great advantage if makers had a voice in the discussion of the rail question, and I find a total absence of such, not only in this, but in the general treating of the rail subject in the States. For, after all, the possibility of making a rail is the first, and the use of it the second question; and I believe much ink might be saved, if practical makers would come forward and give their opinion frankly upon the engineer's scheme.

Irrigation and Rain.

In commenting on Gen. GREELY'S "American Weather," the San Francisco *Call* says that that author evidently shares the notion of certain popular writers that irrigation is only required when the atmospheric precipitation falls below a given number of inches. But the necessity for irrigation only occasionally depends on the rainfall. In some countries, which would be deserts but for irrigation, there is quite a heavy rainfall. Lombardy, which has been irrigated for a thousand years, has some twenty-five inches—six inches more than Sacramento; there are twenty-two inches on the average in the Department of the Bouches du Rhone, where every field is irrigated; some of the oldest irrigation works in Spain are in a region where the rainfall exceeds twenty incnes; back of Madras, in India, where every pound of grain is raised by means of irrigation, the annual precipitation is nearly fifty inches.

Rain, unless it falls at regular intervals and in moderate quantities at a time, is but little help to agriculture. At Madras, where twenty-four inches sometimes fall in a single storm, it is a nuisance to the farmer. What the earth wants to bring forth its increase is a steady, uniform supply of water in small quantities throughout the season when plants are growing and fruit is filling out. This is attained in the Eastern States and in northern Europe by a rainfall which in the aggregate is excessive, but which in the average is well distributed through the growing season. It is not attained in the country west of the Missouri, even in places where there is considerable rainfall, because the precipitation is not distributed and does not come at the precise time when it is needed.

There is no part of California where the people are more in earnest about irrigation than in northern Colusa county, where they have an annual rainfall of 30 ins. Gen. GREELY will find, if he inquires of the intelligent gentlemen who represent his bureau in this State, that there are two classes of lands requiring irrigation here,—one, lands which will yield crops without irrigation, but which will double their yield under the influence of a regular supply of water—say a cubic foot per second to 150 acres—during the growing season; the other, desert lands, which will yield nothing at all without an artificial supply of water either from a system of irrigation works or artesian wells.

A NEW GRADE-CROSSING BILL reported to the Connecticut Legislature provides that on highways existing when the railway was constructed, or on which the grade was established by request of the railroad company, the cost of removal of grade crossings shall be paid by the railway company. At other crossings, 40 per cent. of the cost of removal must be borne equally by the town and the State.

The Cause and Manner of Early Failure of Track.

The accompanying cut, reproduced from *Stahl und Eisen* of May, 1886, preaches so good and short and true a sermon on the greatest cause of early track failure, and on the direction in which cure must be sought, that we have determined to reproduce it, although somewhat late, leaving it for the most part to speak for itself. Though of course exaggerated, it is a perfectly true sketch of the nature of the changes which come about in track under hard service, and which must be remedied before rails of any kind of rail section, round cornered or sharp cornered, flat top or curved top, light or heavy, will render the service that they ought to, or give very good track while they are in service. In other words THE JOINT is the weak point of track, and lets it deteriorate gradually into the condition shown. The drawing, to be sure, shows only the old style of plain fish-plates; but with angle bars of equal length the result is just the same, and it comes about almost as quickly, while the only gain from heavy sections (a very important gain) is to put off the evil day a little longer.

The Cause and Manner of Early Failure of Track.

The evil results come from the very nature of the rails. If we have a beam of given span fixed at both ends and loaded in the center (say a part of the middle of the rail) and we then cut it in two under the load (as at a joint) so as to give us two beams of half the span each, fixed at *one* end and loaded at the other, each with half the original load, the natural deflection of the two half-beams, after cutting, carrying the same total load, is as nearly as may be *ten times* as much as it was before. Hence the strength of the rail itself counts for little at the joints, and does not suffice to distribute the load over a great number of adjacent ties, as it does in the middle of the rail. The ties immediately under the joint have to take the whole impact of the load, unaided by the rail, and hence they sustain at least twice as heavy loads as those in the middle of the rail, besides being subjected to a kind of rocking or pumping motion. Hence the joint ties must go down more than other ties; and it is the jumping of the wheels over the depressions thus caused, and not any jumping over the trifling crack between the rails, which causes the great wear at the joint, which is greater, moreover, just beyond the joint, if the traffic be in only one direction over the rails, that of the arrow in the cut. On single-track rails this effect is not so pronounced, although in cases a greater depression of the rail surface will be found on each side of the joint than at the joint itself.

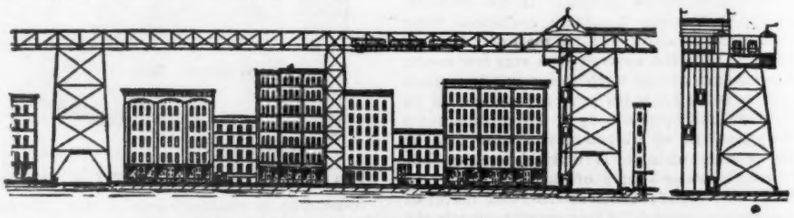
It follows from the preceding that the trouble taken by various roads from time to time to bevel the rail-ends, so as to eliminate the square crack, is a mere waste of time and money. Whatever may appear to ears on the lookout for some improvement, the bevel joint does not really improve the riding of the train nor increase the life of the joints sensibly, if at all, for the reason that it does not *strengthen* the rail. The excessive depression at the joints, which really does the mischief, remains unchanged, and wear and sinking of joints goes on as before. For this reason, the Manhattan Elevated Railway, after a thorough trial of the bevel joints, abandoned them as useless.

But two remedies for the state of things we picture have now much standing before the public, viz., the long three-tie angle-bar joint, 36 to 42 ins. or even more, and the Fisher bridge joint. If anything can be regarded as settled, it is that no form of shorter fish joint, angle-bar or not, is permanently effectual, and whoever lays down such short joint with new rails is, therefore, in our judgment, making an unfortunate mistake. We have not yet heard of any one who has tried the long three-tie joints, however, but speaks well of the results, nor do we know of any one who has tried the modern form of the Fisher joint but speaks well of the results with that. To us the principle of the Fisher joint seems by far the more correct, and we anticipate that it is the type which will ultimately prevail; but, whatever theoretical objections may be raised to the long angle-bars, practical experience with them is so favorable, so far, that they are deserving of recognition as an approved device. Whether time will bring a change of attitude, as it did with the short angle-bars, which for a time were regarded as a final solution of the joint problem, remains to be seen.

Proposed High-Level Rapid Transit.

A civil engineer of Chicago, Ill., Mr. H. A. STOLTENBERG, has lately proposed for that city a scheme of high-level rapid transit somewhat similar in its features to suggestions several times made editorially in this journal. The irregular manner in which Chicago is cut by the river of the same name running through it makes the system adopted in New York and other cities undesirable if not practically impossible. As Mr. STOLTENBERG says, a perfect system of reliable rapid transit can only exist where the entire road is constructed in one uninterrupted whole, and drawbridges would be particularly objectionable in any such scheme. To obtain an underground system in Chicago, it would be necessary to sink the road-bed at least 60 ft. below the street surface to pass under the river; but the usual objections to underground travel would doubtless prevail in Chicago as in other cities.

Mr. STOLTENBERG proposes to carry his tracks at an elevation of about 120 ft. above the street level, with piers in the main and smaller cross streets, as shown in the elevation here given. This elevation would clear eight or nine story buildings, and the high-level section on the Ninth Avenue line, in the northern end of New York City, is pointed out as a specimen road of nearly equal height in actual use. The truss-spans here proposed are not given; but as the Chicago blocks are as nearly uniform in size as possible, and, measured from street centers, are 660 ft. long by 330 ft. wide, the distance between pier centers can be figured. The maximum span would probably be 330 ft.



Proposed High-Level Rapid Transit Road for Chicago, Ill.

To reach the track level, it is proposed to use elevators, one at ordinary stations, and two or more at stations in the business centers. Each elevator would be designed to carry 60 persons, and to make the round trip in 1½ minutes, a capacity equal to 36,000 persons per hour.

The advantages claimed for this system by Mr. STOLTENBERG are that it is practically the only elevated system that will apply in an unbroken line or series of lines to the whole area of Chicago, and that its elevation above the houses will avoid much if not all of the annoyance usual from elevated travel, particularly as the projector advocates the bedding of the rails after the Berlin system.

These are about the same points of advantage already urged by this journal in speaking of a high-level road for New York, with the piers in the centers of the blocks in our case; but to avoid the trouble feared in securing right of way in Chicago, we propose to purchase all ground beneath the track, and thus, while absolutely controling it, depend upon the rental for a return upon the capital invested. It would doubtless be extremely difficult to obtain in any other way the requisite rights and privileges. We also propose four lines of rails, one pair over the other, as better providing for local and express traffic. When it is a question of 300 to 500 ft. spans, the extra cost of this double system is worth the expenditure, as the same right of way, and practically, the same piers, will enable the traffic to be double at all points when circumstances demand it, and at all other times provide for a very popular division of traffic. The history of the expansion of rapid transit in New York makes it certain that a double-track system on the plan proposed for Chicago would scarcely be opened to travel before its projectors would have reason to regret that they had not provided for more tracks. Any such system as that here proposed would cost enormously, and it would be false economy not to design it for the maximum reasonable capacity.

The Suram Tunnel; Trans-Caucasus Railway.

The Trans-Caucasus Railway, between Batoum, Tiflis, and Baku, is described by Mr. THOMAS URQUHART in a late issue of *Engineering*, and the Suram tunnel, now under construction, is illustrated.

The author says that between Baku and Mixailova, at the foot of the mountain on the Asiatic side, the profile of the line presents no remarkable features; but between Mixailova and Beshatuhau, on the European side, the profile rises at the rate of 1 in 22, with curves of 560 ft. radius in some places. To take up this grade 13 cars, aggregating 210 tons in weight, requires two Fairlie locomotives each of 65 tons adhesive weight.

The Suram tunnel will reduce the gradients on the eastern slope to 1 in 100, as a maximum, and to 1 in 40 on the west slope; the lighter gradient being with the main trade coming from the Caspian Sea, the 1 in 40 grade is no serious impediment to the comparatively light trade from the Black Sea. The total length of the new line, from Baku to Batoum, will be 563 miles.

The tunnel is being built for a double-track of the Russian 5-ft. gauge. Its total length is 2.47 miles, and its estimated cost is $5,000,000; it is to be finished by Jan. 1, 1890. The tunnel is being constructed by the Russian Government. Work is divided among several contractors. Brandt & Brandan, Prussian engineers, have undertaken to drive the 8 ft. 9 in. by 8 ft. 9 in. clear heading for $24.98 per lineal foot, they supplying all shops, steam and hydraulic power, tools, engines, etc. They are to receive a premium of $75 per day for each day saved in driving this heading under the contract stipulation of a normal day's progress of 9 ft. 4 ins. for each face. As a consequence, work is being pushed day and night. The Brandt hydraulic drill (described in ENGINEERING NEWS, Jan. 19, 1884) is being used, and two machines are at work at each end of the tunnel.

The four locomotives used in the tunnel were specially made for this work at Colomna, near Moscow. They are of the Krauss type, with inclined boilers, so that the tubes are level notwithstanding the incline in the rails. They are 0.9 m. gauge, two of them weighing 15 tons each and two 10 tons each. They are fitted with the Urquhart petroleum firing appliances. And to obviate smoke in the workings, steam is raised to 15 atmospheres, outside the tunnel, in the exceptionally large boilers, so that there is no necessity for a fresh fire inside. The accumu-

lated heat in the brickwork in the furnaces serves to keep the steam up and prevents cold air from getting at the tube ends.

The heading is driven at the bottom of the tunnel, after the English method, and the hydraulic plant, including the Brandt drills, is all arranged to work at 100 atmospheres pressure. But as the rock is rather soft, 30 atmospheres are sufficient. A progress of about 20 lineal feet is made in 24 hours, with seven holes 4 ft. 10 ins. deep for each attack, and an average daily consumption of 106 lbs. of dynamite for each face.

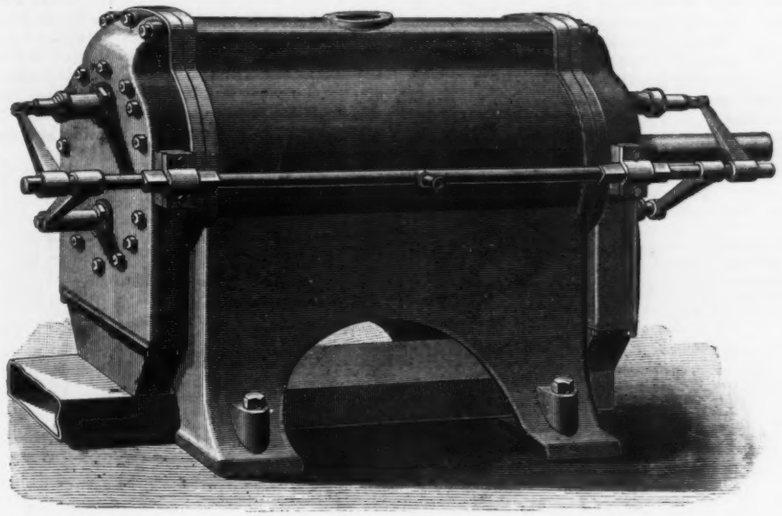


Fig. 1. The Rand Mechanical Air Valve General View.

The tunnel section is of horseshoe shape, 23 ft. 2 ins. high from top of rail to intrados of arch, and 29 ft. 4¾ ins. in extreme width. There will be a heavy lining of masonry throughout. The plant includes a saw-mill and wood-working establishment, a machine shop, engine and boiler house, locomotive shed, smith shop, and cement stores. The entrance to the tunnel is 2,553 ft. above the sea level.

A New Mechanical Air Valve Gear.

This is a device for securing the positive movement of air valves, devised and built by the Rand Drill Co., of New York. It stops chattering, and thus allows the valves a full lift and the full passageway due to the area, really making one valve do the duty of seven or more of the ordinary type, and in a 20-in. compressor it saves no less than 14 valves and springs for each cylinder.

The principle of this gear is as simple as its construction. The usual form of valve chatters because the air tries to pull it open while the spring tries to pull it shut, and first one and then the other prevails. This device simply releases the valve from the pressure of the spring while the valve is open. The spring is used to close the valve, and is made strong enough to do this positively; but before the valve opens, and while it remains open, it is entirely released from the pressure of the spring, and hence it goes wide open and stays there.

In Fig. 2, A is a sliding bar, driven by the main valve stem in the class A and B compressors, by the Corliss wrist plate in the Corliss engine compressors, and by an eccentric in water-power compressors. Arms a, b, a', b', are keyed to the bar. In the position shown, arm a has engaged the washer i and moved it to the left, away from the nuts j, thus releasing valve g from the pressure of the spring c. Similarly arm b', through rod c' and tube f', has released valve h' from the pressure of its spring. The two valves are thus at liberty to open wide and stay there. At the proper moment the springs are relaxed, and as the crank passes the center the valves close. The most peculiar and remarkable feature of the device is that it fulfills perfectly the varied requirements of the discharge valves without any additional mechanism whatever. The movement of bar A is so timed that the discharge valve spring is lifted before the valve is ever wanted to open, the pressure of the air upon the valve (aggregating from 500 to 1,000 lbs.) being ample to hold the valve to its seat. The spring being relaxed, whenever the pressure in the cylinder equals the pressure in the receiver, no matter what that may be, the valve is ready to open and does open widely and freely. One peculiar feature of the inlet valve movement will not fail to attract attention. The movement of bar A is so timed that the compression of the inlet spring occurs some time before the piston reaches the end of its stroke, consequently when the piston commences its return stroke, the spring being already compressed, the valve is at liberty to go wide open *at once*, instead of waiting for the slow movement due to an eccentric, as is the case with the absolutely positive movements.

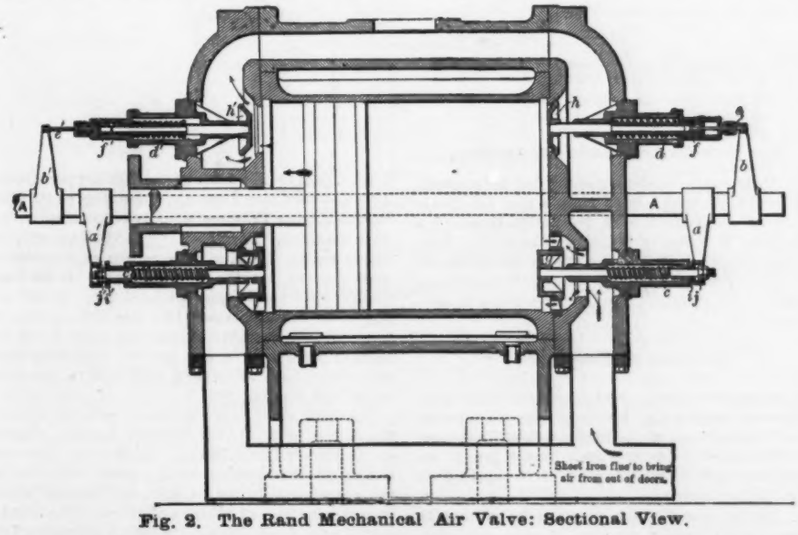


Fig. 2. The Rand Mechanical Air Valve: Sectional View.

As will be seen, the inlet valve is provided with a guard, and, to lessen the clearance which exists between the valve and guard of the usual form, the valve is here made hat-shaped, as will be understood from the illustration. The clearance due to this form of valve is two-tenths of 1 per cent. which is much less than with the usual form of valve with guard, and is believed to be lower than with any form of valve that has been proposed.

New Street Pavement Construction.

A novel system of pavement construction has been patented by Mr. S. B. JEROME, of 29 Murray St., New York. His plan is to use creosoted wood blocks, bored at or near their centers and then strung upon an iron rod stretching from curb to curb and screwed up at each end by washers and nuts. If deemed desirable three or more sets of rods can be used in the width of a street.

The inventor claims that the blocks will be held close together and they will longer resist decay from moisture, they can not be displaced individually and will better distribute any passing load. By making the blocks slightly thicker in the upper part a flat arch effect is secured, with the curbs acting in a measure as abutments.

Among the other advantages enumerated by Mr. JEROME is the adaptability of this system of pavement as a covering for subways to contain electric wires above and sewer, water, gas and steam pipes below. In this case he proposes to locate two such subways, one just outside of each curb, with four heavy vertical brick walls on a concrete base extending up to the patent pavement, cast-iron brackets in the subways would directly support the pavement over the subways and at the same time carry the cables for the electric transmission. A very similar arrangement, with a double covering of trussed block pavement, is figured as applying to underground rapid transit. The inventor says that terra-cotta or asphalt concrete blocks can be substituted for wood when preferred, and that an expensive base is not required to keep this pavement smooth and in good order; he thinks that a bed of broken stone for drainage and coarse and then fine gravel as a top dressing and tamped is all that is required.

This is one of the new projects that must be tested by actual use before much can be said in its favor. The objections that arise from a mere examination of the plans are as follows: If tension enough is put upon the rods to actually compress them there would seem to be a decided tendency to buckle about the crown of the street; there is no longitudinal tie between the sets of trussed blocks, and the straight cross joints would only be as tight as they could be laid originally; even if a very flat truss could be secured by means of the rod, the curbstone as ordinarily made would be insufficient as an abutment to resist horizontal thrust, and as a covering for subways, large or small, the pavement would probably be sorely lacking in water-tight qualities.

THE MEXICAN CENTRAL RAILROAD has increased as follows since 1885:

	Mileage.	*Earnings.*	*Expenses.*	*Net earnings.*
1885.....	1,361	$3,559,561	$2,033,100	$1,526,461
1888.....	1,631	5,774,331	3,418,707	2,355,494
Incr. p. c...	19.8	62.1	68.1	54.2

The net earnings per mile have increased 28¾ per cent., which is not bad, although showing rather slow growth. The gross earnings per mile are now $3,540 per mile, which is about the average of the Canadian lines. The earnings of the road will no doubt continue to slowly but steadily increase.

THE STEEL POSTAL CAR put in service on the Louisville, New Albany & Chicago about the middle of January has traveled 40,000 miles and has stood the service exceptionally well.

The Rowell Automatic Safety Stop.

A test was recently made at Neponset, Mass., on the Old Colony Railroad, of a new automatic safety stop for railway trains, which is illustrated in the cut herewith, with successful results. The device appeared to promise to be of great practical value as an additional safety appliance in the operation of railways, while its mechanism is quite simple. The inventor of the device, Mr. B. C. ROWELL, of Boston, was for many years a working brakeman and conductor, and like all intelligent railroad men realized the fallibility of the present railway danger signals. Torpedoes and red lights are not always effective in stopping trains under certain conditions, as in a blinding snow-storm or a fog, at high speeds, and are at best crude appliances. The device which we illustrate is designed to positively stop any train before reaching a point of danger, without depending upon the vigilance of the engineer, the apparatus being entirely out of his control. That this affords the only real safety is the theory on which all interlocking apparatus is based, and is abundantly proved by experience. On one of the vertical posts of the engine pilot is attached a cock, which can be opened by a small rod sliding vertically 1 in. This cock is connected by a pipe to the train-brake in such a manner that on opening the cock, the pressure is relieved in the brake-pipes, and thus sets all the brakes on the train, bringing it to a stop. At the lower end of the sliding rod is a steel roller, which strikes upon an inclined plane, which is placed just outside one of the track rails, and which, when thrown up, is 4 ins. above the rail level. This inclined plane, when struck by the small roller, gives the necessary motion to the rod to throw open the cock.

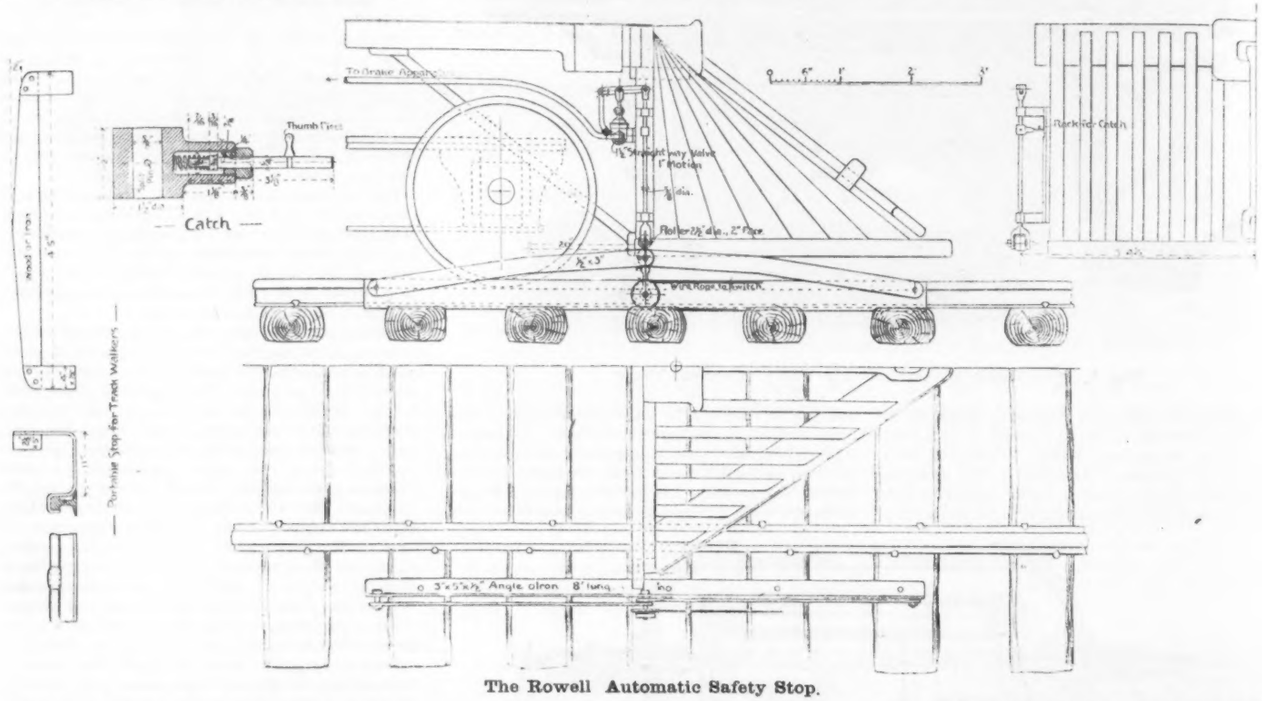
In practice, the inclined plane, permanently fixed beside the rail, consists of two flat bars placed edgewise, one of which is slotted where the bars are connected midway, the outer ends being fulcrumed on a stiff angle-iron bolted to the crossties. A crank arm, or cam and a small wheel, over which runs a wire rope, is connected with the switch to be protected in such a manner that whenever the switch signal is set at danger or the switch is misplaced, the bars are thrown up at a distant point, making it impossible for the train to reach the switch without first coming to a stop. A small catch on the sliding bar on the pilot holds the cock open, and makes it necessary for the engine driver to dismount and reset the cock before he can move the train.

Hydraulic power can also be used for operating the inclined planes, which are placed at a sufficient distance from the switch to stop the train before reaching it.

A portable stop, shown at the side of the cut, is made of wood and iron so as to weigh but a few pounds, and is designed to be carried by section men. This can be hooked over the rail at any point to protect a dangerous place, and it is needless to say is much more effective than the red flag or lantern, since it is bound to act positively. A red flag may be connected with it, and it then becomes unnecessary to keep a flagman out.

At the exhibition of the invention, there were present the Massachusetts Board of Railroad Commissioners, the principal officials of the Old Colony Railroad, and of the other roads terminating in Boston. The experiments were entirely successful, the train of five cars, having about three hundred interested spectators on board, stopping at low speeds in about an engine length, and at full speed in about the length of the train, beyond the point where the device acted.

We understand that the Old Colony Railroad is to equip their entire system, comprising 485 engines, with the device, which is so simple that its cost is trifling in comparison with its practical use as a safeguard. A company will shortly be formed, having headquarters in Boston, to supply the appliance to railways generally; and it appears to us to be in all respects an excellent idea, and deserving of general attention.



The Rowell Automatic Safety Stop.

The Cost of Dredging.

Mr. ANDREW BROWN, principal partner of the firm of Messrs. Simons & Co., Renfrew, has contributed to the "Transactions of the Institution of Engineers and Shipbuilders" in Scotland, issued lately, an interesting paper on dredging which is reported as follows in *Engineering*:

Mr. BROWN describes the many types of vessels in use—bucket ladder dredgers, hopper dredgers, sand pump and dip bucket hopper steamers; but the important question treated is the cost of dredging in connection with various harbor improvements now in progress in different parts of the world. At Belfast, great changes have recently been and are still being made, and Mr. T. R. SALMOND, engineer to the Harbor Trust there, gives, through Mr. BROWN, some details of the cost of dredging in cutting the new channel to the sea and deepening the entrance channel to the new graving dock. Two dredgers of 850 tons hopper capacity have been in use, and they themselves take the material 11 miles down channel. Since commencing work in 1885, one of the vessels has in working expenses absorbed £14,163., and raised 1,767,900 tons of material, giving a cost of 1.92d., while the other vessel has taken for working £13,175., and dredged 1,748,800 tons, or 1.80d. per ton, or a total of 3,516,000 tons at 1.86d. per ton. This sum includes wages, coal, stores and repairs. A small part of the time the vessels were worked by single crew, while for 18 months they worked day and night by a double crew, and electric light was used.

In an average week of 6 days the vessel took 17 loads, dredging 20 hours and 45 minutes, and with the engines working 74 hours 5 minutes. The quantity discharged was 14,450 tons of free sand and clay, and it was deposited 10 miles down channel. The crew numbered 14 men, the coal used was 800 cwt., oil, 82 pints, and waste 12 lbs. In an average week's work of 6 days and nights (24 hours), the number of loads was 27, the vessel's engines working 118 hours 20 minutes. The dredging plant worked 35 hours, 40 minutes, and the quantity raised was 22,250 tons of clay and free sand, and it was deposited in the sea, as in the other case, 10 miles distant. The coal used was 1,100 cwt., oil, 88 pints, and waste 7 lbs. Taking the work of another hopper dredger *Leven*, of 800 tons capacity, belonging to the Dumbarton Harbor Trustees, equally economical results were obtained. Mr. J. WATT SANDEMAN, who had her in use at Blyth, gives a return of the average work done in 12 weeks, day and night. In 531 hours dredging the vessel raised 153,243 tons, or 288 tons per hour, the steaming time was 210½ hours, the material being removed about two miles to sea and there deposited. The cost per ton, including wages and stores, but exclusive of hire, repairs, and interest on first cost, is 1.03d.

The working of another type of vessel is given on the authority of Mr. G. FOSBERY LISTER, engineer to the Mersey Docks Board. In this case the vessel is a single screw hopper steamer fitted with 4 dredging cranes and dipper buckets, and having hopper capacity for 900 to 1,000 tons of débris. The average cost per ton for dredging, including conveying 7 or 8 miles to sea, is 1.78d., made up of .81d. crew's wages, .31d. coals and stores, .66d. repairs and maintenance. In Bombay, the *Kuphus*, of 1,000 tons capacity, dredges and takes the material 4 to 5 miles to sea at a cost of 1.50d. per ton—the average of a year's work; at Grangemouth the hopper dredger *Forth*, working tides, dredges and takes the material 18 miles away at 2d. per ton.

At Port Glasgow the dredger *Clyde* takes 1.85d. per ton to dredge, but she has three steam hoppers, each of 500 tons, to take it down the Firth 8 miles, and the cost of this is 1.83d., a total of 3.68d. per ton, but this includes interest and depreciation, and it is noteworthy that the cost in the case of the two hopper dredgers at Belfast, including interest and depreciation is 3.27d., and 3. 15d. per ton, the average of 3 years' work day and night.

Form of Rails and Wheels.

The Committee of the American Society of Civil Engineers on the "Proper Relation to each other of the Forms of Rails and Wheels" have issued the following circular copies, of which have been sent to all those known to take a practical interest in the matter, whether members of the Society or not. They invite responses from all interested however, whether they have received copies of the circular or not.

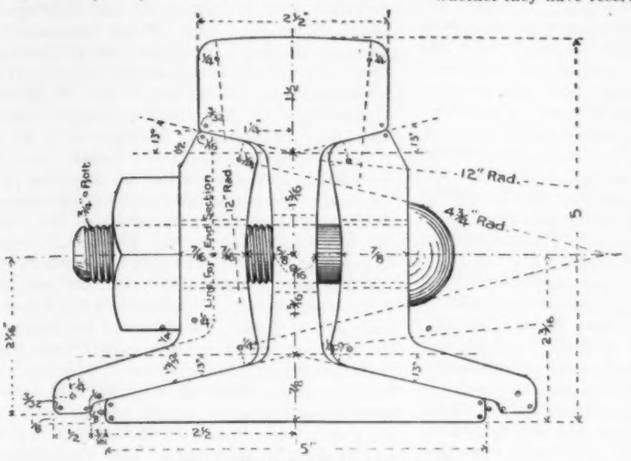


Fig. 1. Michigan Central Standard.

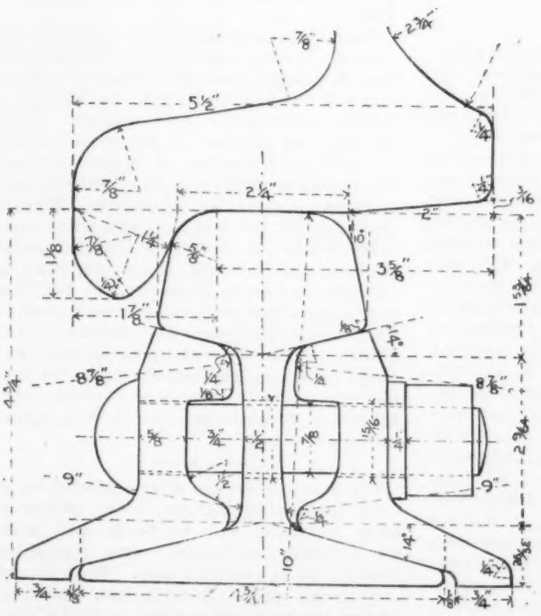


Fig. 2. Lehigh Valley Standard.

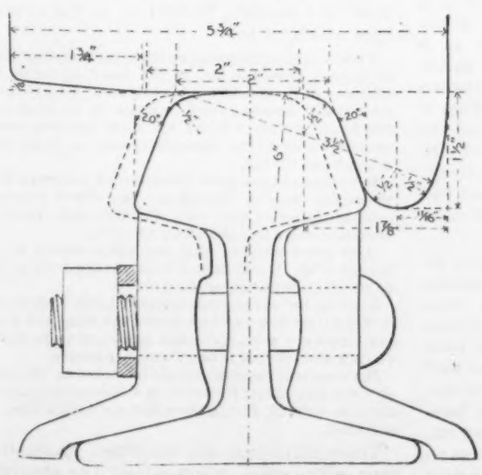


Fig. 3. Cumberland Valley Standard.

The Committee desire to supplement their last circular, which showed only one section (Fig. 1 herewith), by submitting with it two other sections, the three together being typical of *all* the varieties of practice which exist. You will greatly aid the Committee in the work of preparing a final report, (especially if you have not yet answered the first circular), by answering briefly the following questions in regard to each of these sections. The preliminary report of the Committee, giving all the facts which they could collect, and the preliminary conclusions which the facts seemed to warrant, was published in the Transactions of this Society, for *July*, 1888.

Please state if you approve or not the following features of the rail sections shown in Fig. 1, (a lately adopted standard of the Michigan Central Railway)? *A.* The ¼ in. corner radius? *B.* The 12 in. top radius? *C.* The vertical sides? *D.* The very small lower corner radius? *E.* The broad head relatively to depth?

Do you approve or not the following features of the rail section shown in Fig. 2, (the standard of the Lehigh Valley Railroad)? *A.* The ⅝ in. corner radius, identical with a similar fillet radius for the inner corner of the flange? *B.* The 10 in. top radius? *C.* The decided flare of the sides? *D.* The high and large head relatively to base?

Do you approve or not the following features of the rail section shown in Fig. 3, (the standard of the Cumberland Valley Railroad)?

A. The corner radius identical with fillet radius of wheel?

B. The extension of the identical form of rail and wheel to afford bearing contact over the entire side of the rail and inside of flange, instead of over a part only?

C. The general form of the head?

The following general questions are then asked:

(1). Do you consider that the evidence submitted in the Committee's report, published in the Transactions of the Society for July, 1888, together with your own experience and observations, warrants accepting as final conclusions the preliminary conclusions as to causes of sharp flanges, outlined, etc., at the foot of page 28? If not please, state your objections.

(2). Do you consider, on the same basis of fact and personal experience, that the preliminary conclusion as to rail-wear stated near the bottom of page 35, "that the rate of rail-wear grows very materially greater as the rail corner is rounded off to fit the fillet of the flange," may properly be accepted as a final conclusion? If not, please state your reasons.

(3). Do you consider that the engravings on page 38-9, with your own observations and experience, warrant the conclusions that worn rails in service take a top radius of about 12 ins., seldom much less or more, and a corner radius of about ¼ in., or somewhat more? If not, please state your own conclusions.

(4). Do you regard as warranted by the evidence the preliminary conclusions stated in the two paragraphs at the bottom of page 44? If not, why not.

(5). Do you regard as warranted the preliminary conclusions as to fillet radius, on page 45, at the end of the report?

(6). Mr. DON J. WHITTEMORE, Past President Am. Soc. C. E., Chief Engineer of the Chicago, Milwaukee & St. Paul Railway, in a paper of which advance copies have been published by the Society, objects to any top curve at all, and proposes an entirely flat top between the rail corners. Do you deem this likely to be effective in reducing rail-wear, and advise recommending an entirely flat top?

[Answers to be sent to Committee on Rails, care JOHN BOGART, Sec'y Am. Soc. Civil Engineers, No. 127 E. 23d. St. New York.]

Horse Power and Sails on Early Railways.

A correspondent of the Washington *Star* has been ransacking the National Museum for some of the earlier motors on railways, the experiments of a period when the steam locomotive was still looked upon with doubt and distrust. He says that in 1829 a Mr. C. E. DETMOLD contrived, for use on a South Carolina railway, a car propelled by an endless chain attachment worked by a horse, treadmill fashion. This car, the "Flying Dutchman," ran on this road for some time, and attained a speed of 12 miles per hour. A similar expedient had been previously tried on the Baltimore & Ohio Railroad; but as it worked indifferently well, and on one occasion ran into a cow and dumped a lot of editors into the ditch, the press of that region was unanimous in pronouncing the experiment a practical failure.

After the horse experiment, the Baltimore & Ohio road next had recourse to the wind as a motor, and a sailing car, known as the "Meteor," was invented by EVAN THOMAS, and ran for some time "whenever the wind was favorable." This car made good time with the wind abaft or on the quarter, but with the wind abeam it would capsize at times, and no wind at all caused some provoking delays. The Charleston *Courier*, of March 20, 1830, describes as follows an experiment with a sailing car on the South Carolina railway:

A sail was set on a car on our railroad yesterday afternoon in the presence of a large concourse of spectators. Fifteen gentlemen got on board and flew off at the rate of 12 to 14 miles an hour. Thirteen persons and 3 tons of iron were carried about 10 miles an hour. The preparations for sailing were very hastily got up, and of course were not of the best kind, but owing to this circumstance the experiment afforded high sport. The wind blew very fresh from about northeast, which, as a sailor would say, was 'abeam,' and would drive the car either way with equal speed. When going at the rate of about 12 miles an hour and loaded with 15 passengers, the mast went by the board with the sail and rigging attached, carrying with them several of the crew. The wreck was descried by several friendly shipmasters who kindly rendered assistance in rigging a jury mast, and the car was again put under way. During the afternoon the wind changed so as to bring it nearly ahead when going in one direction, but this did not stop the sport; as it was ascertained that the car would sail within four points of the wind. We understand it is intended by some of our seamen to rig a car properly, and shortly to exhibit their skill in managing a vessel on land.'

Sail cars have been used on the level roads of Holland, Spain, and China. C. J. BASCOM, of the Kansas Pacific road, constructed a car with a mast 11 ft. high, having a triangular sail with 2 booms. With a favorable wind it would speed over the plains at the rate of 40 miles an hour. At Barnegat beach, railroad men frequently hoist a sail on construction cars and take advantage of the wind. On the Maiden island in the South Pacific a tramway 5 miles in length, constructed for the purpose of bringing guano from the guano fields to the harbor, is operated by sail-power and by hand. The trucks are pushed up to windward, loaded, and then sail is made and the train moves along at a fine rate. On these islands there is nearly always a fair wind. The locomotive truck carries a single mast in its center, rigged with a large sail.

THE SUNDAY REST MOVEMENT is commended by the chief officials of the Grand Trunk, the Delaware & Hudson Canal Co., and the Lackawanna system. Mr. HICKSON, of the Grand Trunk, states that as long ago as February, 1888, he telegraphed to the managers of all the roads leading from Chicago east, asking them to coöperate in the stoppage of all unnecessary work on the Sabbath. The movement thus started seems now likely to achieve a pronounced success.

FAST STOCK TRAINS are to be again put on between Chicago and Missouri river points, the Chicago & Northwestern having withdrawn from the recent agreement to consume not less than 32 hours in running stock trains from the Missouri river to Chicago.

ENGINEERING NEWS

AND AMERICAN RAILWAY JOURNAL.

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EDITORS.
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GEO. H. FROST. ..... BUSINESS MANAGER

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Drawings for publication *should preferably be in plain black and white, considerably larger than they are expected to appear, with letters and figures in pencil only, all lines clean and bold.*

Coming Technical Meetings.

Civil Engineers' Club of Cleveland, O.—Regular meeting, May 14 Report on Applied Science. Secy., James Ritchie, Case Library Rooms.

American Society of Mechanical Engineers.—The annual meeting will be held at Erie, Pa., May 14, 15 and 16. Secy., F. Hutton, 64 Madison Ave., New York City.

Boston Society of Civil Engineers. — Regular meeting, May 15. "High Service System of the Boston Water-Works," J. A. Gould Jr.; "Measurements of Flow of Water at the Boston Water-Works," C E Haberstroh. Secy., S. E. Tinkham, City Hall.

American Society of Civil Engineers, New York.—Regular meeting, May 15. Secy., John Bogart, 127 E. 23d St.

Engineers' Club of St. Louis, Mo.—Regular meeting, May 15. "Trussing a Building against Wind Pressure," Prof. J. B. Johnson; "Fire Proof Flooring," P. M. Bruner. Secy., Wm. H. Bryan, 709 Market St.

New York Railway Club.—Next meeting, May 16. Rooms, 13 Liberty St., New York City.

Engineers Club, Philadelphia, Pa.—Regular meeting, May 18. Secy., Howard Murphy, 1122 Girard St.

Engineers' Society of Western Pennsylvania, Pittsburg, Pa.—Regular meeting, May 21. Secy., S. M. Wickersham, Penn Bldg.

American Institute of Electrical Engineers.—Annual meeting, May 21 and 23, at 127 E 23rd St., New York.

Engineers' Club of Kansas City, Mo.—Regular meeting, June 3 "Strengthening Iron Bridges", Chas. E. Taylor. Secy., Kenneth Allen, 310 Baird Building.

Denver Society of Civil Engineers.—Regular meeting, June 4 Secy., W. W. Follett, Tremont block.

Western Society of Engineers, Chicago, Ill.—Regular meeting, June 5. Secy., John W. Weston, Gaff Building.

Association of Civil Engineers, Dallas, Tex.—Regular meeting, June 7. Secy., E. K. Smoot. 15 No. Jefferson St.

New England Railway Club, Boston, Mass.—Regular meeting, June 12. Boston & Albany passenger station.

IN the midst of the great centennial festivities of last week it seemed almost an impertinence to offer our weekly budget of technical matter. Once in a hundred years at least, a newspaper like an individual might be excused for dropping shop and devoting itself rather to patriotic rejoicing; and we have this special reason to be thankful that there was occasion for the centennial: that except for the event which it celebrates there can be no reasonable doubt that there would have been to-day no ENGINEERING NEWS. Had the thirteen States remained practically independent of each other under the old Confederation (or finally separated from each other as they would have been more likely to do) there can be no reasonable doubt that there would to-day have been hardly half the population and probably much less than a quarter of the wealth and industrial activity which now exists in this country; and still more would this be so had we remained British colonies. Our revolution, without doubt, was a "blessing in disguise," to both contestants. It taught the Georgian dynasty a sharp and severe lesson which did much to secure to the British nation, and especially to its colonies, the freedom and good government which they now enjoy; while it is possible that we, without it, would still be thirteen overgrown colonies in leading strings, without our vast trans Mississippi dominions, and looking to London for enlightenment in engineering and in everything else. As London would have been a far different and less enlightened London than it is to-day, great would have been our loss.

It was fitting that so great an event should be celebrated with all possible éclat, and it was so celebrated. The vast mass of spectators, the perfect order and good humor, the absence of a single fatal accident, the rarity of intoxication, and above all, the way in which every house and building in the whole city was decorated, by rich and poor alike and by the poor even more profusely than the rich, without any aid from committees or the public purse, were features of which we well be proud.

BUT in one respect which appeals especially to engineers, the "triumphal arches," the celebration was anything but creditable. Out of the four arches that were built, there was but one which was not in the most wretched taste. The wooden imitation of a marble arch at the foot of Fifth Ave. was of graceful and pretty design, with the serious exception that if it had been what it purported to be, marble, it would have fallen to the ground at once, from having too thin abutments. This was in a measure forced on the designer from the limited space available, and we rejoice to learn that there is likelihood of reproducing the arch in marble with this defect corrected, on the opposite side of the street, as a permanent memorial. But the two most conspicuous arches at the "grand stand," not only had this defect in aggravated form, the alleged structures having been absolutely without stability if their painted stone had been real stone, but otherwise obtruded their temporary and make-shift character on the eye of every observer. A skeleton of scantling and boards was covered with painted canvas, and this again was plastered over with ridiculously drawn and roughly painted figures of continental soldiers, and even—to add the last touch of vulgarity to their design—with a flat card-board image of the Father of his Country himself, crowning the arch as a statue! It was not even attempted to throw the intrados of the most pretentious arch into a curve; it was in four straight lines! That it should have been seriously attempted to honor the memory of the man who never told a lie by erecting such monstrous lies as these, was more than an exhibition of individual bad taste; it amounted almost to an impeachment of our civilization.

For the offence against good taste was all quite unnecessary. The timber frameworks might with even less expense have been dressed with evergreens and flowers, and been things of beauty; or they could have been covered with bunting and flags, and yet told no lie, while being more effective for the moment even than stone; or they could have been covered undisguisedly with wooden lattice, and decorated with flags and flowers;—anything or nothing would have been better than what was. Who was responsible for these monstrosities we have not heard, and do not wish to hear. He has wisely concealed his identity.

THE Pennsylvania Railroad is now experimenting with a system of car lighting by gasoline, which, if the official directions for using it do not exaggerate the precautions necessary, it would seem might just as well be let alone. As the closing article of the instructions state, "gasoline is a very volatile and very inflammable substance." It is, roughly speaking, the most volatile and inflammable eleventh part of the naphtha products of crude petroleum, which naphtha products aggregate about one-sixth of the crude oil, of which, consequently, gasoline, is about 1½ per cent. Naphtha proper has three recognized grades, which boil at 180°, 220° and 300° Fahr. respectively. Gasoline of 85° Beaumé boils at 120° Fahr. Gasoline of 88° Beaumé, the grade specified, boils at a still lower temperature, verging toward that of rhigoline, the lightest and (almost if not quite) the most volatile of natural fluids, which boils at 65° Fahr., and brings down the mercury to —19° Fahr., in 20 seconds. The line between these various petroleum products is not sharp, but good illuminating oil is not permitted to have a higher boiling point that 350° Fahr.

Gasoline is extensively used, with great precautions, for the manufacture of illuminating gas on a small scale for isolated buildings, and with wonderful safety, considering its highly inflammable and volatile nature. Nevertheless, distressing accidents from its use do frequently occur. A tremendous naphtha explosion in Chicago, so recently as April 26, caused a great deal of damage. Recently also, a man's life was lost, and a fine house destroyed, by his clothes becoming insensibly charged with the vapor, which ignited on approaching a furnace in the cellar. On trains it is evident that as great precautions as are possible with stationary gas machines are out of the question, while the demonstrated efficiency of kerosene, gas, and electricity for lighting cars makes it difficult to see why such a substance as gasoline should be tampered with for this use.

THE gasoline system above referred to, we may reasonably believe, is as perfect as such a system can be made, and under all ordinary conditions, with regulations lived up to, is perfectly safe. Most dangerous things are. Nevertheless, these are among the instructions given, and all of them made emphatic by being printed in larger type and capitals, instead of in the smaller type which we use:

Under no circumstances should a carburretter lamp be lighted from the top of the lamp or top of the chimney, as is customary with coal gas. An attempt to do this will almost certainly result in an explosion, which will probably break the lamp and may cause serious injury to the operator as well as to the passengers and the car.

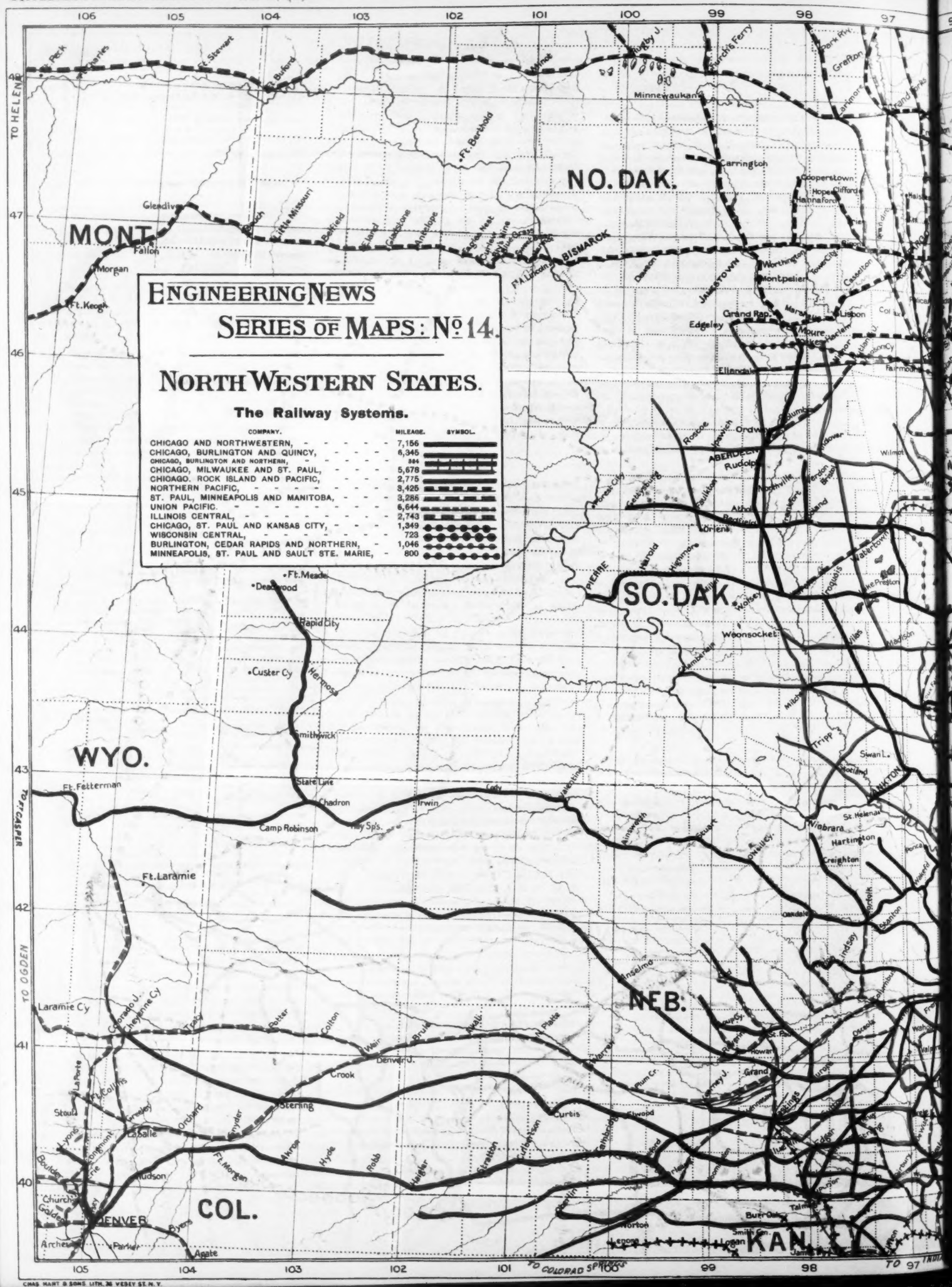
In putting out the lamp it is essential to always close the needle valve on the lamp. This differs from the ordinary practice with coal gas, but with the carburretter lamps it is absolutely essential.

It is quite essential that the lamps should all be burned alike. If less light is desired, turn down all the lights; if more is wanted, turn all up.

Never under any circumstances attempt to recharge carburretters with gasoline during the night, nor when any lights are near, nor when passengers are in the car, nor when the car is in a passenger station.

The barrels of gasoline should be stored in the coolest place obtainable; if possible in a cellar, which should never be entered during the night nor with a lamp of any kind.

These directions are amplified in smaller type with great minuteness. The absolute impossibility of ensuring their enforcement, were such a plan of lighting used on a large


ENGINEERING NEWS
SERIES OF MAPS: No. 14.
NORTH WESTERN STATES.
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SO. DAK.
NEB.
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COL.
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TO HELENA
TO OGDEN
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BISMARCK
PIERRE
DENVER
Minnewaukan
Carrington
Jamestown
Grand Rap.
Edgeley
Ellendale
Aberdeen
Rudolph
Watertown
Redfield
Orient
Huron
Woonsocket
Miller
Tripp
Swan L.
Wisconsin
Hartington
Creighton
Ft. Meade
Deadwood
Rapid City
Custer Cy
Hermosa
Smithwick
State Line
Chadron
Camp Robinson
Ft. Laramie
Ft. Fetterman
Irwin
Valentine
Ainsworth
Laramie Cy
Cheyenne Cy
Denver U.
Crook
Sterling
Curtis
Ft. Morgan
Hudson
Boulder
Golden
Archer
Parker
Agate
Norton
Burr Oak
Smith Cen.
Logan
Ft. Keogh
Morgan
Fallon
Glendive
Ft. Buford
Ft. Stewart
Ft. Peck
Ft. Berthold
Minot
Grafton
Park Riv.
Cooperstown
Hope
Clifford
Hannaford
Casselton
Lisbon
Fairmont
Ordway
Roscoe
Ipswich
Wilmot
Milbank
Madison
Canton
Sioux Falls
Parker
Yankton
Norfolk
Oakdale
Lindsay
Columbus
Grand I.
Kearney J.
Hastings
Superior
Edgar
Fairfield
Clay Cr.
Plum Cr.
Elwood
Palisade
Stratton
Idalia
Wray
Yuma
Otis
Akron
Hyde
Robb
Kiowa
Strasburg
Bennett
Watkins
Byers
Littleton
Englewood
Colfax
Weir
Brule
Platte
Potter
Colton
Tracy
Colorado U.
Longmont
Erie
Lafayette
Louisville
Superior
Crescent
Marshall
Dillon
Stoul
Crowley
Orchard
Snyder
Ryan
Lone Tree
Rocky Ford
Las Animas
Holly
Granada
Lamar
Wiley
Eads
Kit Carson
Cheyenne Wells
Arapahoe
Wray Sp's.
Ft. Collins
Loveland
Berthoud
Longmont
Golden
Church
Pueblo
Trinidad
Raton
Las Vegas
Santa Fe
Albuquerque
Gallup
Flagstaff
Prescott
Phoenix
Yuma
Needles
Mojave
Los Angeles
San Diego
San Francisco
Portland
Seattle
Tacoma
Spokane
Helena
Butte
Missoula
Great Falls
Billings
Miles City
Glendive
Dickinson
Mandan
Bismarck
Jamestown
Valley City
Fargo
Grand Forks
Devils Lake
Minot
Portal
Estevan
Regina
Moose Jaw
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Calgary
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Chicago
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Omaha
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St. Louis
Memphis
New Orleans
Galveston
Houston
San Antonio
El Paso
Salt Lake City
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Laramie
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Green River
Evanston
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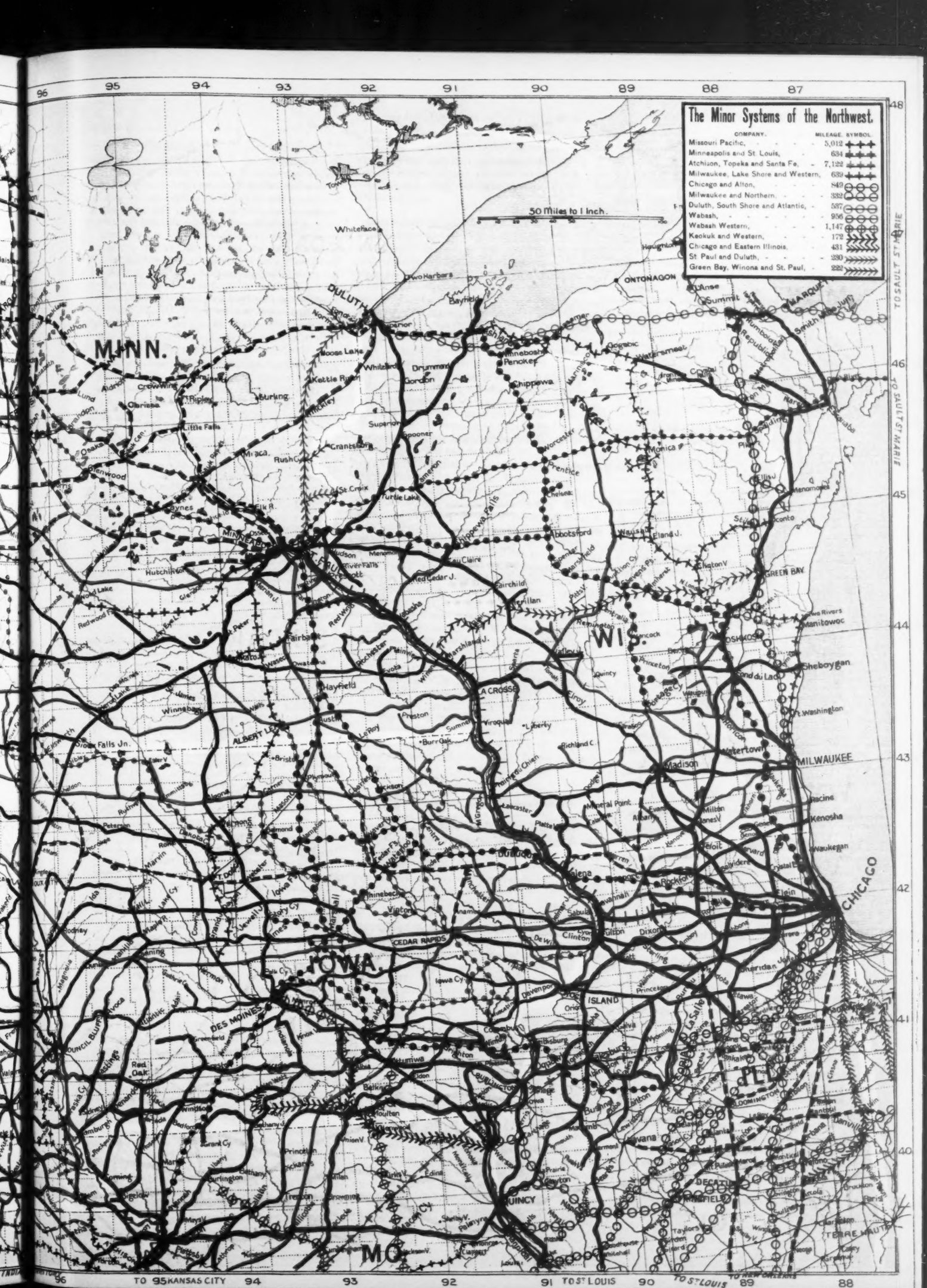
Pocatello
Boise



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scale in the hands of the ordinary reckless employè, and the disastrous consequences which may result from not enforcing them, seem evident. While reluctant to throw cold water on any new enterprise which promises economy (and surely such a system promises nothing but economy as compared with electricity or gas, or even common oil) it is hard to see what advantage can be gained from monkeying with a buzz-saw which requires such elaborate precautions, as compared with what may possibly be lost. If there is another side to this question, we shall be glad to hear and present it; but if we err, the official instructions for the use of the device must also err.

A CORRESPONDENT of *The Engineer* misquotes us first by saying that "A recent issue of ENGINEERING NEWS, of New York, makes a statement that the recent photographs of English locomotives resemble more than ever in appearance the American type of engine," and then continues:

> This is extremely funny. Your contemporary evidently fails to notice that the growing resemblance it observes is due not so much to conformity of English design to Amerian notions, but to the fact that American locomotives are now made to conform to English designs. The points of design which show to the casual observer this more especially are the dome and chimney. The best recent American engines have the English dome and chimney, the old brass candlestick design, so common a few years ago, being now discarded. It is easy to see why this should be so. The English style was first introduced upon the West Shore Railroad, the locomotives on which line were at the date of construction looked upon as the best designed in America. They were designed by the late Mr. FRY, an Englishman, and the whole of the West Shore office was English as regards the locomotive department; and hence English ideas of construction prevailed, and as nearly as possible, with a bar frame, the engines were constructed on English lines, and have been generally accepted in America as standard types of locomotive. The P. R. R. have also adopted English shapes, and even in the wheels English ideas are being introduced, and the cast-iron wheel is losing favor for fast passenger engines. Further, some of the best master mechanics of America are English, and the chief draughtsman of at least one of the best locomotive shops is English.
>
> With all this influence at work, it is hardly to be wondered at that the engines of the two countries should approximate in appearance, though scarcely on the lines indicated by our contemporary, *who evidently has overlooked the fact that both the truck and equalizer are English, not American inventions.*

We have reprinted this extract, partly to lighten up our dull columns a little, but chiefly to again expose the error in the absurd claim advanced in the closing, italicized, sentence. The truth about this matter was published in our issue of Feb. 26, 1887, and in the interest of historic truth we republish that statement in another column. We will now further explain that this whole claim for the English origin of the locomotive trucks and equalizing lever rests on an article in *The Engineer*, of Dec. 31, 1886, the "true inwardness" of which we may as well now make public: The editor of *The Engineer* was informed by an English friend of the present writer that he was about to prepare an article showing English origin of the truck, etc., to appear in an American periodical. The evidence was based on the discovery of certain plans found in the Stephenson shops. The article, before publication, came into the present writer's hands. He saw that, while the facts as to STEPHENSON having the plans were correct, how he happened to have them (by an order from JOHN B. JERVIS for a locomotive so built) was not stated. This and a number of other confirmatory facts were added to the article, completely changing the natural conclusions. The article duly appeared, the editor of *The Engineer* saw it concluded without critical examination (at least this seems the only possible explanation) that it proved what he had been told it would prove, and then published this proof of the *American* origin of the truck under a heading claiming to furnish proof of its *English* origin.

EVIDENTLY many interested readers of *The Engineer* did not go beyond the head line; for his absurd claim, advanced with facts to invalidate it in the same column, still keeps popping up in the English journals. We commend the facts as they are to the author of the above extract at least; and in the meantime will only add that it was to such fundamental differences as the "bogie" truck, equalizing levers, cars, and outside horizontal cylinders that we alluded to in noting the increasing approximation of English practice to our own, and not to trifling details and "outward flourishes" like "brass candlestick" domes and chimneys, in which detail we are quite ready to admit that English practice has from the beginning been more sensible than our own, and has been copied by us to our great advantage. As for the West Shore engines, we shall be the last to say one word to detract from the honor due to Mr. HOWARD FRY, who was indeed an Englishman, and an able and brilliant one, and had full scope in the design of the West Shore engines. His early and lamented death probably prevented his remodelling the West Shore locomotives in detail so as to make them the great success that every one expected they would be; but as a matter of fact the engines have been anything but brilliantly successful, and are consequently anything but "standard types," although in every essential feature they are American locomotives, bar frames and all. Nor was the "English style" of non-ornamentation first seen on that road. It had already begun to creep in everywhere; and, so far as we know, is the only distinctly English feature of locomotive design which shows any tendency to spread in this country. We are not saying that we might not copy some other details to advantage, for we have a strong suspicion that we could: we are speaking now merely of what is, not of what ought to be.

THE President of the United States has taught both military and civil engineers a lesson which some of them badly need, in the following words as to the case of Maj. LYDECKER, which are his comments on the extraordinary finding of the court that "in spaces so confined as those above the arch in the tunnel *it was almost impossible to secure thoroughly good work under the contract system* imposed by law." No less an engineer than Gen. NEWTON testified to this alleged impossibility in almost the same words, being largely biased in his judgment, as we cannot but believe, by *esprit du corps*, and a desire to shield a brother officer, but the finding is most justly rebuked by the President in these stinging words:

> The suggestion that . . . faithful supervision of the progress of such a work is powerless to detect and correct the shams practised by the contractors in this case *is a discredit to the engineering profession, and entirely inadmissible. The sentence seems to have given full effect to every suggestion that might mitigate the offense.*

It is indeed a discredit to the profession that such lame and ridiculous excuses should be either offered or listened to, and it was equally so in the practically identical abuses which were detected here on the New Croton Aqueduct under purely civil adminstration. Honors are easy in that respect between the military and civil engineers, and neither can throw stones at the other; but no disinterested engineer will accept as tenable the excuses made in either case, which sought to throw the whole blame on to wicked contractors, nor believe that more than a very ordinary grade of watchfulness and fidelity to trust was needed to have detected such practices before they had advanced far enough to do sensible harm. Such ordinary fidelity was conspicuously and inexcusably wanting in both cases; and it is surely evidence of a kind of weak indifference to such breaches of trust among Americans, which it is hard to distinguish from moral dry rot, that in neither case should a penalty in any way corresponding to the offense have been inflicted, even in the harmless form of verbal censure.

Mr. SANDBERG'S contribution to the discussion of the rail question, which appears in another column, makes a very good point as to the mechanical objections to rolling a perfectly flat-top rail, and the absolute impossibility of securing a perfect contact on it after it is rolled. The following pithy statement seems to us not only neat but sound:

> I am sure no one could have wished more than I that the complaints generally heard now that the rails are not as good as those made twenty years ago could have been met by such a trifling alteration in the section as making the top flat, but I think the above facts show the reason why that will not do it, but simply make matters worse. The increased pressure of the heavier engines necessitates harder steel both physically and chemically, and in this direction a cure must be looked for.

We do not think there would be either any great harm or great good done by the adoption of perfectly flat-topped rails, but we should lay down this general law as the fundamental one: All attempts to make the normal section of rails and wheels conform exactly to each other anywhere, for any sensible distance, must necessarily be abortive from the fact that wear and the irregularities of construction forbid uniformity. Therefore the attempt should only be made on the clearest and most conclusive evidence that its attainment is theoretically desirable. As respects the corner and sides of the rails, the theoretical evidence is all the other way; and as respects the top, if perfect flatness were the condition of least wear, the rails would wear to it; but they do not. No human eye ever saw, nor do we believe it ever will see, a flat-top worn rail.

The Railway Systems of the Northwest.

WITH INSET MAP.

There can be little doubt that the section of the United States shown on the map which accompanies this issue has had a more rapid and remarkable growth, during the score of years just closing, than any other section of the country. The area shown includes the valuable prairie lands of the upper Mississippi and Missouri valleys, the forests and mineral districts of Minnesota, Wisconsin, and the north Michigan peninsula, and the principal coal fields of Illinois and Iowa.

The quick development of this region, its rapid peopling with emigrants from the East and from foreign lands, has been in great measure due to the enterprise of the great railway corporations whose lines are shown on our map. Partly to gain a market for valuable land grants, partly to build up and increase traffic, and partly, no doubt, merely to do their share in keeping up the boom under whose influence the Northwest has grown up as if by magic, the managers of the chief railway systems extending north and west of Chicago have spent hundreds of thousands of dollars in advertising the country and attracting immigrants from every quarter.

At the same time various causes, of which competition between the different companies

is chief, have led them to extend their lines, open up and develop new territory, and absorb independent tributary branches, until the four greatest systems control over 26,000 miles, while the eight whose lines show most prominently upon our map have a total extent of 38,400 miles, or about one-fourth the mileage of the whole United States.

The growth of these great systems has been so rapid that their relative extent and the territory covered by each is quite unknown to the general public, and is none too well comprehended by railway men. Especial attention has been drawn to these systems during the past few months because of the sudden shrinkage in their earnings, and it has been charged that this is due to building extensions into unproductive regions, and to the over-construction of parallel competing lines.

The claim is also made that these greatest systems are so large as to be unwieldy, and investors have been advised to beware of their securities, on the ground that their affairs were so intricate and on so large a scale that no one outside the company's officers could know the real status of the company's affairs. Some of the very men who once were most enthusiastic over the extraordinary growth of these systems are now declaiming against them as "overgrown mushrooms."

All this, whether true or false, has its effect; and it is undeniable that the smaller holders of Western railway securities do lay a part of the blame for the present condition of things on the shoulders of the managers who have been foremost in extending and building up the great systems, and that they are opposed to any further extensions at present. It is of great interest, therefore, at this time to see just what the extent of these great systems is, what sections each reaches, and the relations of each system to its neighbors.

In arranging the systems upon the map, we have classified them in groups of four, and so far as possible in the order of their importance as *Northwestern* systems. Such systems as the Santa Fé or the Missouri Pacific, which are properly Southwestern systems, are thus classed here with the minor systems. They will be fully shown and discussed in connection with our of the Southwestern systems, soon to b issued.

The four primary systems of the Northwest are indicated upon the map by continuous lines of contrasting colors. They are the Chicago & Northwestern and Chicago, Milwaukee & St. Paul, occupying the territory between Chicago and the Missouri river north of the parallel of latitude passing through Chicago; and the Chicago, Burlington & Quincy and Chicago, Rock Island & Pacific, extending between Chicago and the Rocky Mountain and lying south of the same parallel.

THE CHICAGO & NORTHWESTERN.

The mileage of this system, the greatest in the Northwest and exceeded in mileage only by the Pennsylvania system, is now as follows:

	Miles.
Chicago & Northwestern system proper	4,384
Sioux City & Pacific	107
Fremont, Elkhorn & Missouri Valley	1,246
Chicago, St. Paul, Minneapolis & Omaha	1,419
Total	7,156

The railways comprising the Chicago & Northwestern system radiate from Chicago in three main lines. One reaches due west across Illinois, Iowa, and ebraska to a terminus in the Wyoming coal fields at Ft. Casper, 1,100 miles from Chicago. A branch from this line forms the only railway to the Black Hills; and a network of branches ramifies in eastern Nebraska and reaches prominent points in central Iowa and northern Illinois. The main line northwest from Chicago reaches St. Paul and Minneapolis, stretches across Minnesota, and ends in numerous feeders in the James River valley wheat-fields of Dakota. Lines of the Chicago, St. Paul, Minneapolis & Omaha reach from the ports of Duluth and Ashland southwest to the Twin Cities and to important points in Nebraska, Minnesota, Iowa and Dakota. The third main line runs north from Chicago along the lake shore, and secures a heavy and profitable traffic from the mines and forests of northern Wisconsin and the North Michigan peninsula.

The system has had a rapid growth The first line of the system was chartered in 1851 and completed in 1854 from Chicago northwest 35 miles. After various financial misfortunes and changes of name, the Chicago & Northwestern Co. was organized in 1859, and operated the road from Chicago to Oshkosh, Wis., 194 miles. In 1869 the system had an extent of 1,516 miles. During the next decade the growth was much slower, and there were but 2,152 miles in the system in 1879. Soon after, a vigorous extension policy was put in force, and the result is shown in the 5,000 miles which have been added to the company's mileage in the past 10 years. The Sioux City & Pacific and the Fremont, Elkhorn & Missouri Valley systems are operated separately, but are owned directly by the company. The Chicago, St. Paul, Minneapolis & Omaha system was acquired in 1882 by the purchase of a majority of its capital stock.

The Chicago & Northwestern Co. is largely controlled by the VANDERBILTS. Messrs. W. K. and F. W. VANDERBILT, Mr. H. McK. TWOMBLY and Mr. CHAUNCEY M. DEPEW are members of its directorate. The Wagner coaches, in which the VANDERBILTS are heavily interested, are run on all lines of the system. In operation, however, the Chicago & Northwestern is entirely independent of the lines of the Vanderbilt system east of Chicago.

The gross receipts of all lines of the system were about $37,000,000 last year; and the gross charges, including operating expenses, taxes, interest on bonds, etc., were about $30,000,000. There are about 100 miles of double track on the system, and about 10 per cent. of the mileage, at the date of the last annual report, was still laid with iron rails.

The principal addition to its system which the company is likely to undertake in the near future is an extension of the Fremont, Elkhorn & Missouri Valley line across Wyoming, tapping the coal and oil fields of that new State, and thence reaching westward eventually to the Pacific coast. Considerable work is also likely to be done in South Dakota as soon as the Sioux Indian reservation is opened to settlement; for the Northwestern can reach this district more readily than any other system. A line to Kansas City has been much discussed; but as long as the present relations between the different companies of the Northwest continues, the work is not likely to be pushed. The results of 1888 have taught railway managers in the Northwest to beware of competitive extensions. The lines of this system have proved the wisdom of those who planned them by paying a fair return to their owners, when other companies have had to draw on their bank accounts to pay the interest on their bonds. The managers of the system will probably push out extensions enough to develop the territory it already occupies as fast as may be advisable; but they are not for some time likely to do much more.

THE CHICAGO, MILWAUKEE & ST. PAUL.

This system lies in almost the same territory as that covered by the Chicago & Northwestern, but it has no lines in Nebraska or Michigan and it has a southwestern branch reaching to Kansas City. The total extent of the system is 5,678 miles. The original main line extends from Chicago via Milwaukee, Portage, and Sparta, Wis., to the Mississippi river at La Crosse, and thence up its west bank to the Twin Cities. A line extends from Chicago due west across Illinois and Iowa, and then turning northwest runs to a terminus in the James River valley in Dakota at a point 850 miles from Chicago. There are three other main east and west lines: two run from Milwaukee across Wisconsin, Minnesota, and Iowa to termini at Woonsocket and Chamberlain, in South Dakota; and a third line runs from Hastings, near St. Paul, Minn., west through central Minnesota to a terminus near the Missouri river in North Dakota. The other important roads of the system are the recent extension to Kansas City and two lines running from St. Paul southwest, one down the west bank of the Mississippi, and the other through eastern Minnesota and Iowa, to a terminus at Rock Island, Ill.

The original Chicago, Milwaukee & St. Paul company was chartered in 1863, and by 1874 the system had an extent of 1,612 miles, which had increased to 2,052 miles by 1879. During the past decade, therefore, 3,626 miles have been added to the company's system.

The system has pre-eminently a "granger" traffic. In 1888, of the total freight tonnage 26.43 per cent. consisted of flour and grain; live stock formed about 6 per cent., and coal and lumber (principally a return traffic) was 27.18 per cent. The gross earnings in 1888 were, from freight $16,998,118; from passengers $6,031,091. The second and third tracks on the system have an extent of 68 miles.

The total receipts of the company in 1888 were $25,085,904. The operating expenses were $17,377,353. The interest on the funded debt was $7,048,976, leaving only $659,575 for the payment of dividends. The annual report shows that the average freight rate per ton per mile has steadily decreased from 1.80 cts. in 1878 to 1.007 cts. in 1888.

It is quite certain that until the returns from operations show more favorably for the company's stockholders, no extensions of moment are likely to be undertaken. When any new work is begun by the company, it will probably be in Dakota, where it is at present the pioneer in opening up a considerable section. The line which now terminates in the forests of northern Wisconsin is also likely to be pushed on to secure a mineral traffic from the Gogebic mines and to reach some port on Lake Superior.

THE CHICAGO, BURLINGTON & QUINCY.

The mileage of this system is now as follows:

	Miles.
Operated by Chicago, Burlington & Quincy Co.	4,917
Controlled by Chicago, Burlington & Quincy Co., but operated separately	1,428
Total	6,345

As seen upon the map, this system forms a close network of lines extending from Chicago southwest across northern Illinois, southern Iowa, northern Missouri, and the southern half of Nebraska to western termini at Denver and Cheyenne, distant 1,020 and 1,025 miles from Chicago. On the north the lines of the system reach to Rockford and Fulton, Ill., Washington and Des Moines, Ia., and Omaha, Columbus, and various minor points in Nebraska. On the south, two lines reach St. Louis, and two reach Kansas City, while short branches end at Carrollton, Mo., and Atchison, Concordia, and St. Francis, Kan. Within the territory covered by its

lines, every point of importance is reached.

In 1852, the first line of this system was built from Turner Jc. to Aurora, Ill., 13 miles. In 1859, the Chicago, Burlington & Quincy company operated 283 miles of road, and this was increased to 811 miles before the close of 1869. During the next decade the system was extended, principally by the construction of lines in Iowa and Nebraska, until about 1,800 miles were operated by the company in 1870. During the past ten years its growth has been as rapid as that of the other great Northwestern systems, and 6,345 miles are now under its control.

In accordance with the expressed wish of the company's officers, we have not included the Chicago, Burlington & Northern road as part of the Chicago, Burlington & Quincy system; yet according to the official statements of the company's officers, there seems little doubt but that it should be so included.

The Chicago, Burlington & Quincy company spent at the outset $800,000 in making surveys, securing franchises, rights of way, etc., for the Chicago, Burlington & Northern; and when an independent company was organized in 1885, the Chicago, Burlington & Quincy, *as a company*, took one third of the total capital stock, which it now holds. The amount of the stock held by prominent officials of the Chicago, Burlington & Quincy may be fairly assumed to be a considerable amount, and the prices at which the stock can now be bought are not so exorbitant but that the total amount of stock of the company controlled by the Chicago, Burlington & Quincy if it is not now a majority, could be made such on very short notice. Let the Milwaukee & St. Paul or the Chicago, St. Paul & Kansas City company try to obtain control of the Chicago, Burlington & Northern, and see how much stock they could find not held in the interest of the Chicago, Burlington & Quincy. It is acknowledged officially that the Chicago, Burlington & Quincy company planned the road, furnished a large share of the funds for building it, and now owns over one-third of the capital stock. To insist, therefore, that the parent company does not now control the Chicago, Burlington & Northern seems an undignified shirking of responsibility. Technically the statement may be correct; but practically it can deceive no one versed in railway financiering.

If we include this mileage as part of the main system it gives it a total extent of 6,709 miles. The value of this road to the Chicago, Burlington & Quincy company, in giving an independent connection with the systems centering at St. Paul and Minneapolis, is so apparent that it is not at all likely that its control will be suffered to pass into other hands, at least while the present management continues in power.

On the whole system, there are now about 300 miles of second and third tracks, of which about two-thirds are in Illinois and almost all the remainder, in Iowa.

During 1888 the gross earnings of the company were $23,789,168. Operating expenses and taxes were $18,882,460, and fixed charges were $5,996,712, leaving a deficit of over $1,000,000. The net earnings applicable to the payment of interest and dividends decreased $6,571,457 in 1888 from 1887. This decrease was due first to the growth in expenses and loss of traffic resulting from the strike of the locomotive engineers in February, 1888, second to the diversion of traffic to new competing lines, and third to a general reduction in rates caused largely by the serious rate wars of the year. The financial record of the company in the past has been unexcelled by that of any railway corporation in the country. From the formation of the company in 1862 to the close of 1887, a total of 233 per cent. has been paid in dividends, an average of about 9¼ per cent. per annum. Besides this, nearly $7,000,000 has been paid in stock dividends. In no year since the company was organized have the stockholders failed to receive a dividend. This has been accomplished and at the same time a high standard for the operation and maintenance of the road has been adopted and adhered to in every department. The work of extension has been so carried on that the company has done its full share in the development of the West by the construction of pioneer lines; and as soon as the financial situation will permit, the work of construction will be resumed. The line now terminating near the western line of Nebraska is to be extended west and north, and will reach the mining region in the Black Hills and also the coal fields of Wyoming. The Colorado lines are also to be extended to reach the coal fields of that State, which will furnish a heavy traffic to the treeless prairie further east where a large portion of the system is located. Less important extensions are contemplated in Nebraska, where considerable tracts of fair agricultural lands are still without railway facilities.

In considering the prospects of the company, the most serious feature, perhaps, is the fact that the bulk of the system is located in the States of Iowa and Nebraska, the two States which have of late been most active in cutting down railway rates by legislative enactment. On the other hand, it is urged that in the long run wise counsels are almost certain to prevail, and the railways in these States will be permitted to earn a fair dividend for their stockholders. The property has in the past shown itself able to earn a steady return for its owners, through all the good years and bad years, and notwithstanding the short crops and droughts, with which the West has been plenteously afflicted. It is to be hoped that it may be able to continue so to do in the future.

THE CHICAGO, ROCK ISLAND & PACIFIC.

This system has the following relatively small mileage:

	Miles.
Chicago, Rock Island & Pacific lines east of Missouri river	1,537
Chicago, Kansas & Nebraska Ry.—lines west of Missouri river	1,238
Total	2,775

The main line of this system was begun in 1854 and completed in 1869 from Chicago to Council Bluffs, Ia., 500 miles. The Kansas City branch leaves the main line at Davenport, Ia., and runs southwest. Branches reach Peoria, Keokuk, Atchison, and Leavenworth on the south, and Fort Dodge and Ruthven, Ia., on the north. For the lines west of the Missouri river, preliminary surveys were begun near the close of 1885, and during the past three years a system has been completed extending from St. Joseph, Mo., to Colorado Springs, Col., 610 miles. Two long southwestern branches reach to Pond Creek, Ind. Ter., and to Liberal, near the southwestern corner of Kansas, and there are several short branches in Kansas and Nebraska. The company reaches Kansas City over the tracks of the Hannibal & St. Joseph Railway, a part of the Burlington system, and over the Union Pacific, from Topeka. For connections with the Northwest, the company relies principally on the Burlington, Cedar Rapids & Northern and the Minneapolis & St. Louis roads, with each of which it has close traffic relations.

Upon the whole system there are 163 miles of double track.

During the year ending March 3, 1888, the gross receipts from all lines east of the Missouri river were $13,509,727. For the same time the operating expenses and taxes were $8,742,060 and the fixed charges were $2,428,565, leaving earnings applicable to the payment of dividends of $2,339,202.

This is exclusive of the results of operations on the lines west of the Missouri river. These lines, like all others in the State of Kansas, have shown no gratifying returns for the past year; but they may yet vindicate the sagacity of the men who planned them and pushed them to completion, if the State does all that its friends expect in the way of future development. It is the ultimate intention of the Rock Island managers to extend this Southwestern system to points in Indian Territory, Texas, and the coal fields of Colorado. But these extensions, like those of many other systems, will be postponed until the condition of the stock market warrants the company is raising funds for their construction.

The description of the remaining systems shown upon our map we postpone to the following issue.

The Origin of the Locomotive Truck and Equalizing Levers.

The following is an article referred to editorially in this issue, reprinted in the interest of historic truth from our issue of Feb. 26, 1887, in which we pointed out a very extraordinary error of the London *Engineer*, which has since obtained wide currency.

A WELL-PROVED CLAIM.

One of the most extraordinary instances of misconception of evidence which we have ever chanced to see is contained (it our contemporary will pardon us) in *The Engineer* of Dec. 31, 1886, where a claim is advanced in the first three lines which all the remainder of the article clearly disproves. The delightful absurdity of the article, and its amusing evidence of how firmly an English—

"Man convinced against his will
Is of the same opinion still,"

can best be brought out by reprinting the claim and proof together, without note or comment, omitting (as we do) the unessential parts only of an article which, all told, is only a column long:

THE CLAIM.—"It appears that not only the bogie, but the equalizing beam or lever, can be clearly proved to be English inventions, though an American origin is often claimed for both of these useful adjuncts to rolling stock for rough permanent way."

THE PROOF.—"The first bogie used in America was placed in 1829 under some granite cars used on the Quincy Granite Railway, near Boston. These cars had two four-wheeled trucks or bogies free to swivel round a center pin or king bolt, and side bearings or friction plates. The cars were permanent, and not temporary structures."

"CONDUCE GATCH, a foreman on the Baltimore & Ohio Railway—then worked by horses—built some temporary cars for carrying fire-wood in April or May, 1830, consisting each of two four-wheeled cars or trucks, each carrying a swiveling bolster, and connected by three longitudinal stringers. CONDUCE GATCH also claimed that he built the first passenger coach carried on two four-wheeled bogies in July, 1831. Contemporary newspapers contain accounts of the trial trip of this car on July 3, 1831."

"The above are the earliest recorded uses of the bogie in the United States. *It appears to have been first used there under a locomotive in* 1832. In the patent suit known as the 'Winan's eight-wheeled car case,' Mr. JOHN B. JERVIS, one of the best known American civil engineers, *gave evidence that he invented a truck or bogie in* 1831, and that an engine with this bogie was put to work on the Mohawk & Hudson Railroad in 1832. A second engine on a similar plan was put in operation on the Saratoga & Schenectady Railroad early in 1833. The front end of the engine rested on the frame of a four-wheeled truck of the lower frame without necessarily being parallel with it.

"Messrs. ROBT. STEPHENSON & CO. *built their first bogie engine in* 1833. This engine was ordered Jan. 12, 1833, for the line referred to above, by Mr. JERVIS, of the Saratoga & Schenectady. The engine was sent away from Newcastle April 6, 1833, and was set to work in America July 2, 1833. *It is often asserted that this engine, the 'Davy Crockett,' was the first locomotive with a bogie, but that is altogether a mistake, as* SHOWN ABOVE."

"*The bogie engine seems to have been little known to English railway men until* 1839 *or* 1840. In the early part of the first named year, three bogie engines named respectively the "England," "Atlantic," and "Columbia," *were sent to this country by* NORRIS, *of Philadelphia, for the Birmingham & Gloucester line.* They were tried in the first instance upon the Grand Junction, and were apparently not placed upon the railway for which they were intended until 1840. A notice of these engines is to be found in the 'Proceedings' of the Institution of Civil Engineers for 1840, p. 46. In the 'Proceedings' for 1843, p. 99, some particulars are given of another of NORRIS' bogie engines. *It is quite evident from the tone of these papers, and the subsequent discussions, that the idea was new to the most of those who took part in them.*"

Truly an Englishman never knows when he is beaten. A man who can knock himself down and come up smiling in this fashion ought to be exhibited as a curiosity.

But there remains even a lower depth of absurdity for *The Engineer* to fall into, in the same article. If any man in England or in the world might be supposed to know all about the development of the locomotive in those days, it was its great inventor, GEORGE STEPHENSON, in whose works the first "bogie" locomotive was built in 1853, for Mr. JOHN B. JERVIS, as *The Engineer* has just told us. This is what Mr. STEPHENSON knew of this "English invention" in 1836, according to *The Engineer*.

"GEORGE STEPHENSON, in his evidence before the House of Lords Committee, in 1836, said: 'There is a contrivance I saw the other day for passing round curves, but it is by having a center to move on, so as to change the direction of the wheels to suit the curve, like a gentleman's carriage; *'I thought it would not do.'* This might not have been a bogie, but STEPHENSON *says not a word about the bogie engines made at Newcastle, although several questions were put to him about locomotives passing round curves.*"

The claim as to equalizing lever—an invention of unquestionable American origin, first introduced by Messrs. Eastwick & Harrison, in 1837-38, and by 1844 in universal use in America and nowhere else, is equally absurd, resting, as it does, on a single patent specification for a wagon of a type of which there is no evidence adduced, nor probably existing, that a single one was ever built.

We chance to have a shrewd suspicion of how this era came about, which, if our suspicion be correct, would make it something of international episode, and "even a more excellent tale than the other" but we must content ourselves with giving merely the final outcome of the episode.

On the editorial pages of this issue we now state the full facts as to this "international episode," as we understand them, and we suggest to our esteemed contemporary, *The Engineer*, that it would be as well to refer back to its editorial of Dec. 31, 1886, and correct the erroneous claim therein as publicly as it was made. As between England and America it is a trifling matter where the truck and equalizing lever originated, but it is wrong to rob individuals of credit justly due them.

New Jersey Lakes.

A relief map made by State Geologist COOK shows the ponds and lakes of New Jersey which contain over ten acres each. Seven counties of the State have no such bodies of this size. Morris county has twelve ponds and lakes worthy of mention in the report, including Hopatcong, the largest body of water in the State, with its 2,433 acres, and three other famous lakes with over 300 acres area. They are Budd's lake, 475; Green pond, 460; and Splitrock pond, 315; Denmark pond is next, with 172 acres, and Stickle's pond has 110.

Sussex county tops the list with forty ponds and lakes of more than ten acres extent. Of these, Swartswood lake is the most important, with 505 acres in the main pond and 100 more in Little Swartswood. Culver's pond is next, with 486 acres; Stanhope reservoir covers 339 acres; Lond pond, near Culver's Gap, 299; Waywayanda lake, 240 acres, and Morris pond, near Sparta, 136 acres.

Warren county shows ten blue spots of varying sizes on the map. The biggest of these represents Green's pond of 117 acres area, and of the remainder, White pond alone is over 50 acres in extent. It will be seen by the report that seven of the counties are without ponds or lakes worthy of mention.

Passaic county shows twelve sheets of water having area enough to give them prominence. In this list is included Greenwood lake with a total area of 1,920 acres, fully half of which is in New York State; Echo or Macopin lake, with 299 acres; Pompton lake, 186 acres; and the rest all less than 100 acres in extent.—*Dover Era.*

Bad Surveying in Kansas City.

A thorough legal resurvey of Kansas City is needed. Owing to engineering inaccuracies and other causes, there is a lack of uniformity in the lines and measurements which is both annoying and expensive.

In one instance, in the northeast portion of the city, an aggravated ejectment action in the Circuit Court was caused by a misunderstanding in regard to a boundary line. The disputed strip of land was 1 ft. 6 ins. wide, and each claimant had reason to believe himself right. In another case—in Pendleton Heights—it was almost impossible, from the data given, to correctly locate the center line of the street preparatory to cross-sectioning the street as a preliminary to grading. The line finally accepted was 3 ft. from the supposed location, and when grading was done some neatly sodded terraces suffered. In a case in West Kansas from confusing data an expensive party wall in a large brick building had to be torn down, removed and rebuilt.

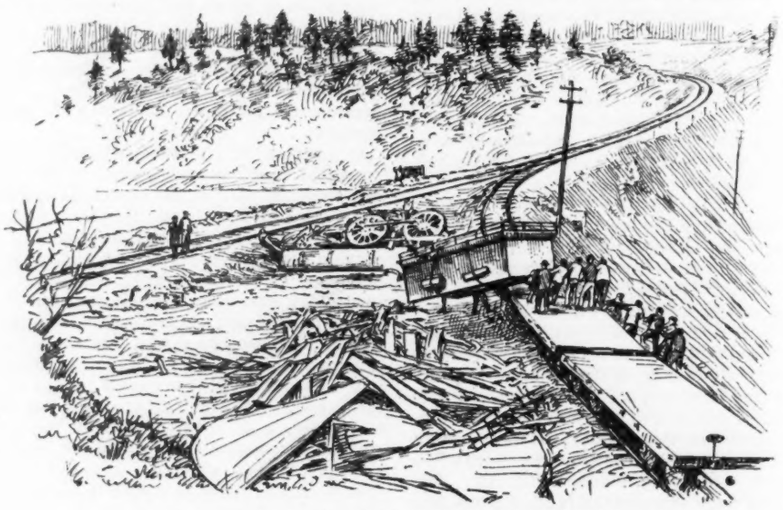
On the west side of Forest Ave., in the vicinity of 9th St., a man who bought a 50-ft. lot got about 53 ft. The block was built up, and every one in it got all the land called for in his deed. The last to be served found an extra 3 ft. that no one could prevent his taking. The property is worth between $200 and $300 a foot.

One source of error was the grading down of the hills and the filling up of the ravines. Surveys of land and lots platted where great inequalities of surface existed do not always coincide with surveys made after the leveling process has been completed.

The reason given for delaying the work of resurveying is that it is still inexpedient to attempt to reduce things to exactness because there are yet many rough surfaces. —*Kansas City Star.*

The Hamilton, Ont., Switch Derailment.

The accompanying sketch shows very clearly the nature of the locality of the recent disaster and the lay-out of the tracks. The sketch was made from a photograph taken some time after the accident and therefore does not show all the wreckage. The accident took place on the line of the Grand Trunk Railway about three miles west of Hamilton, Ont., on the morning of April 28, at what is commonly known as the Y, about a mile past the Desjardins canal. The main line of the old Great Western Railway at that point is about three-quarters of a mile from the Toronto branch, and the two branches are connected by what is known as the Toronto Junction. The joining line is a curve, about a mile in length. On one side of the switch, which is the joining point of the two lines, is a deep ravine or swamp, part of the marsh, and on the other side is a strip of high land. A few yards nearer the city than the point where the accident happened are high bluffs, with occasional bits of swamp land, so that the immediately surrounding country is much diversified.



Scene of Railway Accident near Hamilton, Ontario.

The St. Louis limited Express, No. 52, which leaves Detroit at midnight and is due to arrive in Hamilton at 6.55 A. M., was running 15 minutes late when the accident happened. About 20 miles an hour or a little more was being made, all steam being shut off on the down grade. The train was composed of an engine, two baggage-cars, a smoker and six coaches. In striking the frog, after passing the switch, the engine jumped the track and plunged into a huge tank whose wreck is shown near the foreground. There it came to a dead stand, and the cars in the rear telescoped the baggage-cars, went right over the top of the engine, and alighted on the track about ten yards further on. The engineer and fireman had no time to jump. They were taken from under the engine, the engineer being uninjured and the fireman having only a slight wound. On the train were 115 people besides the ten trainmen. Of these 14 were in the day coach, 35 in one sleeper, 5 in another sleeper, and 11 in a third sleeper, leaving 50 persons in the smoker and two coaches. From 30 to 35 of these were in the smoker. This car and the second baggage-car were telescoped completely and took fire immediately. The wrecking of the tank cut off the supply of water, and the 30 or 35 passengers were at the mercy of the flames. Twenty are known to have perished, and about as many more were more or less injured.

The accident furnishes another of the innumerable instances of the inevitable danger from main line frogs. Had a "frogless switch," like that illustrated in our issue of April 6, been in use, this accident at least would probably never have occurred.

A LETTER from one of our subscribers in New South Wales gives a vivid description of the town and harbor, which, although not entering largely into engineering details, will, we are sure, be read with interest:

Sydney is a very fine town, with extensive suburbs. The whole population is nearly 400,000, which is a large proportion to that of the whole colony, just 1,000,000. Singularly enough, there is no other large town in the colony, and the nearest, in the adjacent colony of Victoria, is 580 miles away. The great feature of Sydney is the harbor. Though I should imagine that the water area is about half that inside Sandy Hook, the length of shore line must be far greater. A more singularly indented shore I have never seen. Deep bays and coves form a perfect procession, and the harbor resembles, on the whole, the impress of some gigantic hand, the fingers of which were long and ornamented with singularly protrusive warts. The rock is sandstone, much of it lying in horizontal beds. The general color is warm yellow, and the building stone is singularly effective. I have seen walls here, no two stones the same color, while some large buildings are just sufficiently variegated in tint to avoid monotony. The rock weathers in most fantastic forms, the top overhanging the base by many yards.

The botanic gardens here are the most beautiful of their kind. Nearly everything grows here. The banana, the lemon, the pomegranate, the grape, the orange, and the apple grow and ripen side by side in ordinary gardens with no extra attention. Frost and snow are of course unknown, while the heat is not excessive.

THE ORDER OF RAILWAY CONDUCTORS is considering a proposal to erect a building for the general headquarters of the Order at Cedar Rapids, Ia.

CORRESPONDENCE.

The Flat-Top Rail Question.

OFFICES, 19 *Great George St., Westminster, S. W.*,
LONDON, April 24, 1889.

TO THE EDITOR OF ENGINEERING NEWS:

I had intended to write you fully as to my views on rail sections, and may do so shortly. Meanwhile I beg to send you my criticism of Mr. WHITTEMORE's paper on flat-topped rails, which you may publish as a supplement to the valuable remarks you have yourself already given your readers, and from reading which I have derived both benefit and pleasure. We are not, on this side, too proud to receive information from foreign periodicals,

and from no country do we receive better and more useful information than from America. I feel particularly indebted to you for the very able way in which you have taken part in the present rail fight. Yours truly,

C. P. SANDBERG.

The Canadian Pacific Snow-Sheds and Glance Fences.

Quebec Central Ry., Engineer's Office,
SHERBROOKE, P. Q., April 28, 1889.

TO THE EDITOR OF ENGINEERING NEWS:—

I must take exception to your paragraph in your issue of April 20, referring to the Canadian Pacific Railway snow-sheds and glance fences. You give the invention of these to Mr. W. C. VAN HORNE. I can quite understand your justly felt pride in having a United States man at the head of Canada's highest undertaking, an undertaking that has not been studied as much as similar ones usually are in detail of construction, although yet far from being "solid" as the European and the more eastern States accept the term. But give the devil his due, at any rate; and let me explain a little. In 1885, Mr. HOFF was sent over the Union and Central Pacific to take notes of snow-sheds, by Mr. JAS. ROSS, of the Canadian Pacific Railway. The results were put in my hands when I commenced the construction of the first snow-shed in the Selkirk Range (November, 1885) under Mr. GEO. ELLISON, who was chief engineer of bridge work. The systems were all braced timber work, with little or no cribbing, with rather complicated joints, and difficult to erect.

The system of a full crib on one side was invented by Mr. ELLISON, and the working out of the details and gallery work I completed in 1886, before construction commenced that year. During the winter of 1885-86 several reports were written on snowshed work, and in one a Mr. G. C. CUNINGHAM put forward the idea of building huge stone walls near the origin of the snow-slides to gather them and keep them in one channel. That was the form of glance fences: the idea was crude in the extreme and impracticable in its way.

In 1886 no glance fences were built; but in the spring of 1887, when the work of continuing the construction of the snow-sheds was given to me, on going over the work with the General Superintendent, who desired to curtail the length of the sheds as much as possible, I suggested a heavy cribbing to guide the slides above the fences and to prevent spreading over the ends. (I should explain that snow-slides bring down with them a mass of débris, which accumulates at the foot, and on which future slides descend, so that they, so to speak, descend on a mound instead of down a gorge). This was only in the cases of lighter slides, and then the thought came: Why should not a gradual deflection be successful, managed in a similar way to that in which ice and water are deflected? That was the idea complete of the glance cribs and fences, and the split fence was altogether my invention, but only an adaptation. What more is any invention than an adaptation or a happy thought?

MR. VAN HORNE certainly did order one shed, peculiarly his own in position, placed square across the track of a huge slide, but one which does not often come down heavily; but when that slide descends in any large mass, MR. VAN HORNE'S fence will be properly called the Canute Fence, as efficacious in its way as the command of that king.

The snowfall in the Yellowhead Pass is much less than on the present line of the Canadian Pacific Railway, and from all I have heard there appears to be a greater snowfall on the more southern lines than on the Canadian Pacific Railway in the Sierra Nevada. I have heard of snow on the flat in broad valleys lying 40 to 60 ft. deep, and this has been partly verified by Mr. T. C. KEEFER. From what I have seen near Quebec during this past favorable winter, I should say that nowhere is so much difficulty to be met with as immediately south and east of Quebec; the drift being far worse than any snowfall I have seen in the mountains, although not so bad as slides. Yours faithfully,

CHARLES A. STOESS.

[We must plead "not guilty" to our correspondent's implied charge that our supposed pride in having "a United States man" at the head of the C. P. R. had anything to do with our assignment of credit for the C. P. R. snow fences. The information on the strength of which we did so was gathered on the spot among the officers and employés of that division, where, before they had been tried, the glance and split fences were popularly known as "Van Horne's pets" and "Van Horne's follies." We have understood, also, that the precise form to be given to these crib protections was dictated by him, and that they were built with many misgivings. We have derived no information whatever from Mr. VAN HORNE direct, however, and as there is quite enough credit undoubtedly his, connected with the construction of the C. P. R., to make him content without seeking any not his own, still less ought we to be open to suspicion of giving him undue credit because he happen to be "a United States man." If we erred, it was not intentionally.

Our correspondent is mistaken in thinking that there is a greater snowfall on the lines south than on the C. P. R. The problem was vastly more serious there than it had ever been on any other line on this continent, or probably in the world. The Northern Pacific has merely a few light "downfall" sheds, built of scantling, and with hardly one-tenth of the timber in them per linear foot that is in the C. P. R. sheds. The Union and Central Pacific sheds are heavier, many of them, but are also comparatively light structures.—ED. ENG. NEWS.]

Pile-Driving Formulæ.

80 Gower St., LONDON, W. C., April 5, 1889.

TO THE EDITOR OF ENGINEERING NEWS:—

In the NEWS of March 16 you have shown that our pile formula

$$\text{Extreme load lbs.} = \frac{50 \times \text{weight of ram, lbs.} \times \sqrt[3]{\text{fall, ft.}}}{1 + \text{final penetration in inches}}$$

gives too great a load in such cases as that where a 2,000 lb. hammer, falling 1 ft., causes a penetration of 1⅛ ins., and that such are the cases (hardly likely to occur perhaps) where "the cube root of the fall may be too low a power," as suggested in my letter of Feb. 26.

On the other hand, the following seem to be the cases where the fall itself is too "low a power," making your formula

$$\text{Safe load in lbs.} = \frac{2 \times \text{weight of ram, lbs.} \times \text{fall in feet}}{1 + \text{final penetration in inches}}$$

unnecessarily safe.

No.	Locality.	Actual Conditions. Ram lbs.	Fall ft.	Penetration ins.	Actual Load lbs.	Safe Load, News' formula.	Extreme load Trautwine's formula.
1	Royal Border bridge, Eng.	1,700	16	0.05	156,810	51,800	210,100
2	Hull Docks, Eng.	1,500	24	2.00	44,800	24,000	74,368
3	Neuilly bridge, Paris.	2,000	5	0.016	105,280	19,685	173,824
4	Chestnut St. bridge, Phila.	1,200	20	0.75	40,320	27,430	95,872

These about complete the experimental data that I have been able to find, I omitted them from my former letters because the extreme load was not given, and of course the load sustained is not necessarily the *maximum* safe load. I mention them now only for your own consideration, and do not ask for their publication, as I do not want to be misunderstood as wishing to "retaliate." Besides, the cases obtainable are so few, and some of them apparently contradictory, that it is hardly fair to take them as final evidence for or against a formula. A formula must be "elastic," indeed, to adapt itself to such dissimilar cases as

		Ram lbs.	Fall ft.	Penetration ins.	Extreme load lbs.
5.	Brooklyn Navy Yard	2,240	30	0.5	224,000
6.	Pensacola "	2,000	30		91,800

which illustrate, I think, not only the care needed in the use of *formulæ*, but that needed in accepting the experimental *results* themselves, which must often be greatly affected by conditions unsuspected and therefore unrecorded. Yours truly,

JOHN C. TRAUTWINE, Jr.

[We take the liberty of publishing this interesting communication, giving further data on this subject, and do not think any one can suspect Mr. TRAUTWINE of a desire to "retaliate," or of anything but a wish to get at the real facts. We will only say that these additional instances seem to us to confirm the substantial correctness for practical use of the simple formula

$$\textit{Safe-load in lbs.} = \frac{2\,w\,h}{s+1}$$

as above quoted by Mr. TRAUTWINE. It is to be noted that all four of the tabular examples above, but especially Nos. 1 and 3, are driven by old-fashioned methods which are no longer common, and all four of them, moreover, show higher actual loads than are warranted by any formula, while the Chestnut St. foundation has had to be reconstructed because of failure, although that failure does not seem to have been due to vertical yielding of the piles. Calling the actual load 1.00 in each case, the ratio of the loads given by formula to these loads is as follows:

	Actual load	News formula safe load	Trautwine's formula extreme	Trautwine's formula safe (= ⅙ extr.)
1	1.00	0.33	1.34	0.45
2	1.00	0.54	1.66	0.55
3	1.00	0.19	1.65	0.55
4	1.00	0.68	2.37	0.76

The safe loads for Nos. 2 and 4 are almost identical by the two formulæ, and No. 1 not greatly different. No. 3 is materially different, but we cannot but believe that a pile which only penetrated $\frac{1}{20}$ in. per blow under a 2,000 lb. hammer falling 5 ft. might under a 3,000 lb. hammer falling 20 ft. penetrate several inches; in other words, the blow is not severe enough to fully test the stratum on which the pile rests. Moreover, the Neuilly bridge was built in 1768-80. No one would now think of driving piles in the same fashion, so that it is unnecessary that a modern formula should fit very closely to such cases.

Examples Nos. 5 and 6 above compare as follows:

	Actual load.	News formula safe load.	Trautwine formula. extreme.	Trautwine formula. safe (= ⅙ extr.)
5.	224,000	89,600	232,004	77,335
6.	91,800	80,000	267,147	69,049

Here the correspondence is close enough. That the load imposed in Case 5 is not really safe is indicated by the choice of the much smaller load in Case 6. That such great loads as in Case 5 may be occasionally warranted by necessity and favoring conditions is undoubted, but when they are imposed it is better that it should be done by increase from a *universally safe* formula than by decrease from what is in fact merely a *universally unsafe* formula; for, although the weaknesses of our common human nature make us object to low safe values as a unit which we can exceed only with a consciousness of taking risks, and prefer rather a very high unsafe value, which we can simply cut down *a little* and still deceive ourselves with the notion that we are being cautious and careful, there is no need nor excuse for taking chances in such matters, as a rule. Piles like Case 6, above for example, which by our formula are good for 80,000 lbs. will, if driven 3 ft. between centers, sustain a column of masonry a yard square and 40 yds. or 120 ft. high. Does any engineer in his senses want to put more than that on a single pile if he can possibly avoid it?—ED. ENG. NEWS.]

Notes, Queries and Answers.

W. E. W. We hardly think such an earth-work table would pay. To cover all the ordinary range of practice the table would have to be of vast extent, and the same quantities can be taken equally well from diagrams which run up to all cases of 30-ft. center heights in the space you take for 5 ft. You should not have cumbered your table with decimals of a cubic yard, which is an absurdity in earth-work computation, nor have omitted the hundreds. There is but limited demand for such tables, the varieties of conditions being great. Still, it would cost little to lithograph the tables, and they might sell enough to repay the cost. We have seen none like them.

C. E. C. The expression Rs. 35,42,857 which puzzles you means simply 35 *lacs* of rupees and 42,857 rupees, or 3,542,857 rupees, a *lac* being 100,000. The *lac* is by custom made the unit for large sums of money (its present value being about $40,000) rather than the single rupee. This absurd notation is puzzling to almost every one, and is explained in no printed book that we know of, but is universal in India.

BOOK REVIEWS.

The Manual of American Water-Works, compiled from Special Returns. Containing the History, Details of Construction, Source and Mode of Supply, Pumping Machinery, Distribution, Consumption, Pressure, Hydrant Rental, Revenue and Expenses, Cost and Debt, etc., etc., of every Water-Works in the United States and Canada. With Summaries for each State and Group of States, and Directory of Water-Works Officials, Engineers and Contractors. M. N. BAKER, Ph. B., Editor. First Annual Issue, 1888. New York, ENGINEERING NEWS Publishing Co. 8vo., cloth, pp. 611. $3.00.

As this work is published by us, it is hardly proper that we should enter into any elaborate discussion of its merits and demerits. The book may better be left by us to speak for itself. As our readers may naturally desire and expect, however, to have some general idea of the scope and character of the volume given them, we make the following extracts from the preface and introduction of the work, and will only add to them that the book is all that the title says it is, and that, while we expect each year to make it more complete, it is already very complete as regards every work described, and that it is highly improbable that any single water-works, large enough to be called such, has escaped record. That there are no errors of detail not yet detected is not to be hoped for. We trust, however, that all readers will be on the lookout for such and duly advise us of them.

"After more than a year of work in collecting, compiling and summarizing the accompanying information the publishers submit the first annual issue of the American Water-Works Manual to the water-works officials, engineers and contractors of the country, and to those capitalists who invest in water-works securities, as well as to all who take an intelligent interest in the sanitary and financial questions involved in the construction and maintenance of water-works systems.

"The accompanying volume is the first Manual of American Water-Works, properly so-called, which has ever been published, not even the number of water-works and the most essential data in regard to them having been before accurately known. In the year 1878 the publisher of ENGINEERING NEWS made the first attempt in that direction, having arranged with Mr. J. JAMES R. CROES, C. E., of this city, the well-known hydraulic engineer, to compile for this journal the "History and Statistics of American Water-Works," and the result of his very careful and successful work was embodied in a little volume under that title published in 1883, and again in revised and enlarged forms in 1885 and 1887, as also in a series of sketches of the various works which have been published in ENGINEERING NEWS from time to time since 1881, and have constituted the basis of the present volume.

"The first (1883) edition of this record gave in tabular form more or less details as to 793 water-works; the second (1885) edition gave similar information as to 989 water-works; the second (1885) edition gave similar information as to 989 water-works, and the third (1887) edition gave similar information as to 1,391 water-works; but in each issue there were a large number of works unavoidably omitted, and the information which could be secured from those water-works which did report was often so scanty that it was found impossible to attempt summaries or tabulations of States or sections, exhibiting in aggregate the status of water-works.

"This issue describes 1,666 water-works in the United States, 68 in Canada and 3 in Newfoundland. Reports from about 40 new works were received too late for insertion in the body of the Manual, and are given in the appendix, together with a few corrections to the preceding matter.

"Aided by the growing interest which these prior publications created, the publishers have at last succeeded in eliminating nearly all those sources of error and imperfection, and are now able to present, not only practically complete statistics of the water-works interest of the United States, but likewise to embody a vast amount of information as to the history and construction of the individual water-works which has either never been in print before or has only existed in inaccessible form.

"This Manual will be issued annually hereafter, and it is hoped and expected to make it each year more complete and valuable; for, while the publishers feel that they have reason to be well satisfied with the present volume as the first issue of the series, it is necessarily not as complete as it will gradually become.

"The errors in this volume will be corrected in our next (1889) issue, and the financial, historical, and technical matter will be considerably extended. It will enable this to be done more effectively if all readers will examine the account of water-works with which they may be, or may have been, connected, and supply any omissions of matter which ought to appear. The records not here given which are particularly desired are the status of all the earlier water-works at the ends of the decennial periods 1860, 1870, 1880, and in 1885, in respect to cost, miles of mains and number of taps, hydrants and meters, in order that we may exhibit fully the status of water-works at each date, which it is impossible to do in this with exactness."

PUBLICATIONS RECEIVED.

—*Professional Biography of* MONCURE ROBINSON, *Civil Engineer*; with portrait. Philadelphia, 1889.

This is a handsome privately printed sketch of the professional life of one of the very oldest of living American engineers, one who was intimately connected with the early engineering history of this country, and was prominent as a consulting engineer before the present professional generation came upon the field. No author's name is given, but we recognize the work of Mr. RICHARD B. OSBORNE, C. E., who was for many years associated with Mr. ROBINSON in his engineering works, and to whom we are indebted for the materials for a briefer sketch of Mr. ROBINSON lately published in this journal.

Catalogue and Price Lists of Brown & Sharp Mfg. Co., Providence, R. I. April, 1889.

This catalogue of 200 pages illustrates and describes, in make and purpose, a multitude of mechanical appliances of interest to all engineers and to those connected with engineering works. The name of the makers of these tools has long been synonymous with accuracy, extreme finish, and the perfection of mechanical design, so nothing further need be said on that head. But aside from the more important machine tools, this catalogue shows a great variety of the gauges, calipers, rules, etc., for which this firm is famous, and which have an especial interest to every engineer and railway man who values accuracy. Among these latter may be mentioned a great variety of micrometer calipers, with tables for using them; all manner of steel rules, straight-edges, squares, triangles, draughtsman's protractors, vernier calipers, standard wire gauges, etc. These catalogues are sent by mail on application.

—*A Theoretical and Practical Treatise on the Strength of Beams and Columns*; in which the ultimate and the elastic limit strength of beams and columns is computed from the ultimate and elastic limit compressive and tensile strength of the material, by means of formulas deduced from the correct and new theory of the transverse strenght of materials. By ROBERT H. COUSINS, 8vo. cloth, $5.00. E. & F. N. SPON, Publishers, 12 Cortlandt St., New York.

We shall review this work in a later issue.

PERSONAL.

Mr. L. STIMSON has been appointed Street Commissioner at Whatcom, Wash. Ty.

Mr. J. N. SHEPARDSON has been appointed Superintendent of Streets at Pittsfield, Mass.

Mr. MARCUS BOWEN has been appointed Superintendent of Roads at Lenox, Mass.

Mr. F. H. CRANDALL has been appointed Superintendent of Water-Works at Burlington, Vt.

Mr. R. A. BRYAN has been reappointed, for the tenth successive term, as City Engineer of Portsmouth, Ohio.

Mr. H. A. PARKER has been appointed Assistant to President CABLE of the Chicago, Rock Island & Pacific Ry. Co., with headquarters at Chicago, Ill.

Mr. C. W. SCHAAP, Auditor of the Cleveland, Akron & Columbus Ry., has resigned his position, which he has held for seven years.

Mr. E. BUTTS has been appointed First Assistant Engineer under Major O. B. GUNN, City Engineer of Kansas City.

Mr. EZRA CLARK has been re-elected President of the Water Commissioners at Hartford, Conn. He has held this position for 15 years.

Mr. F. HUTTON, Secretary of the American Society of Mechanical Engineers, has moved the Society's offices in New York from 280 Broadway to 64 Madison Ave.

Mr. JOHN W. CLOUD, Buffalo, N. Y., has been elected Secretary of the Master Car-Builders' Association and has accepted the position.

Mr. C. A. COCKROFT, Eng. N. Y. State Canals, has about completed his work on the rebuilding of Lock No. 60, Black River canal.

Mr. W. M. CLEMENTS, General Manager of the Baltimore & Ohio lines east of the Ohio river, has resigned.

Mr. FRANK RIBLETT, Surveyor and Civil Engineer, of Cassia Co., Idaho, is a candidate for the office of Surveyor-General of Idaho.

Mr. ALFRED H. RAYNAL has resigned his position as Superintendent of the Delamater Iron Works, New York, to accept that of Manager at the Richmond Locomotive & Machine Works, Richmond, Va.

Mr. JOHN THOMPSON, designer and agent for the Colt's Armory and Universal presses, has removed his office to the Temple Court building, Nassau and Beekman Sts., New York City.

Mr. JOHN K. V. AGNEW, General Superintendent of the Chicago & West Michigan, has also been appointed General Superintendent of the Detroit, Lansing & Northern and Saginaw Valley & St. Louis roads, vice Mr. THOS. M. FISH, resigned.

Chief Engineer BISSELL, of the Denver, Texas & Fort Worth, who has been acting as Superintendent of the central and northern branches of the road, has been appointed to the position permanently.

Mr. W. W. BOND has been appointed Superintendent of the Vicksburg & Meridian and Shreveport & Pacific railways, to succeed Col. H. F. CLARK, who has resigned to accept a position on the Cincinnati Southern.

Mr. LEWIS KINGMAN has resigned his position as Asst. Engineer of the Atchison, Topeka & Santa Fé Ry., and has accepted the position of City Engineer of Topeka, Kan.

Mr. J. WALDO, of the International Traffic Association, has been appointed General Traffic Manager of the Missouri, Kansas & Texas Ry., with headquarters at Sedalia, Mo.

Mr. WM. WILSON FINLEY, General Freight Agent of the Denver, Texas & Gulf road, has been appointed Cahirman of the new Trans-Missouri Railway Association. The headquarters of the Association are at Kansas City.

Mr. THOMAS F. GILROY is now Commissioner of Public Works of New York City, in place of Mr. D. LOWBER SMITH. In the suit between the two claimants of the office, Judge BARRETT decided that Mr. SMITH'S term ended May 1.

Mr. GEO. D. WADLEY has been appointed General Manager of the Kentucky Union road. Mr. WADLEY was formerly engineer of construction on the Mexican Central, and more recently Superintendent of the Owensboro & Nashville division of the Louisville & Nashville lines.

Mr. A. W. MACCALLUM, formerly Superintendent of the Massillon Water Co., of Massillon, O., is now located at 326 Benson St., Camden, N. J., and is General Superintendent for the water-works at Chester, Sharon and Corry, Pa.; Vincennes and Greencastle, Ind.; Mobile, Ala., and Denison, Tex. His office is at 400 Chestnut St., Philadelphia, Pa.

Mr. H. B. ABBOTT has been appointed Superintendent of Docks, at Buffalo, N. Y., for the Lehigh Valley R. R. He will have direct and sole charge of all the business of transfer of traffic from cars to warehouses or boat, and from boats to cars or dock, and all matters pertaining to the transfer of lake and rail business. He will report to the Second Vice-President through his assistant, ROLLIN H. WILBUR, at South Bethlehem, Pa.

FREDERICK AUGUSTUS PORTER BARNARD, D. D., LL. D., who recently died in this city, was born in Sheffield on March 5, 1809. He graduated from Yale College in 1828; was subsequently a teacher in deaf and dumb asylums in Hartford and New York, and from 1837 to 1848 was professor of mathematics and natural philosophy, and until 1854, professor of chemistry in the University of Alabama. In 1854 he was a professor in the University of Mississippi, and in 1856 was elected President and in 1858 Chancellor of the same institution, resigning in 1861. In 1864 he was chosen President of Columbia College, New York, a position which he held until very recently. In 1860 he was a member of the astronomical expedition to observe the total eclipse of the sun in Labrador, and was elected President of the American Association for the Advancement of Science. In 1862 he was engaged in the reduction of Gilliss' observations of the Stars in the Southern Hemisphere, and in 1863 had charge of the publication of the charts and maps of the United States Coast Survey. He was one of the incorporators of the National Academy of Sciences (1863) and was Chairman of its physical division. In 1867 he was United States Commissioner to the Paris Exhibition. He was a member of a number of learned societies in America and Europe, and he received the honorary degrees of LL.D. (Jefferson College, 1855, Yale College 1859) S. T. D. (University of Mississippi 1861) and in 1872 that of Doctor of Literature from the Regents of the University of New York. He was the author of a number of scientific and progressive works, and in 1874-77, in conjunction with Professor ARNOLD GUYOT, he edited Johnson's Universal Cyclopedia.

SOCIETY PROCEEDINGS.

American Society of Civil Engineers.—At the regular meeting held May 1st, in the midst of the Centennial, Vice-President FTELEY in the chair, the following minute, offered by Mr. J. J. R. CROES, was, on the motion of Mr. C. B. BRUSH, seconded by Mr. GEO. S. GREENE, Jr., ordered to be entered on the records of the Society and published in its Proceedings.

In the commemoration of the assumption of office by the first President of the United States, one hundred years ago, the American Society of Civil Engineers may properly take part, and pay a tribute to the memory of WASHINGTON.

Before he became a soldier, long before he entered on his career as a statesman, his inclination led him in the direction of engineering. We are told by his biographers that he was of a mathematical turn of mind, and that his first public occupation was that of a surveyor. At that early period, before great public works had been or could be undertaken, division and development of land was the principal field of engineering, and was the essential preliminary to that knowledge of the resources of the country and of the needs for their development which must precede the formulating and carrying out of any works in which the skill of the constructing engineer is brought into play. Into this field WASHINGTON entered, and not only made extensive surveys but also designed and executed some works which are still extant for the improvement of the channels of Virginia rivers.

He might have turned his attention to the chief occupation of the gentlemen of his day and neighborhood, the cultivation of his farms; but he preferred the broader field of promoting the extension of the areas of farming land, and the means of transporting its products to a market. He might have taken up the practice of one of the so-called learned professions, law or theology; but he was content to obey the law and the gospel as they stood, neither perverting the one nor controverting the other.

We may well imagine that if he had pursued the course which he began, he would have become eminent as a civil engineer, for he displayed in his career the characteristics which go to make up the highest grade of that profession,—breadth of view, careful attention to detail, caution in examination, firmness in decision, vigor in action.

During his official life, he was careful to entrust work requiring engineering skill to educated and experienced engineers. He secured the services of Major L'ENFANT of the French army as his Chief of Engineers, and to him was later entrusted the laying out of the city of Washington.

In the promotion of great enterprises for the improvement of the country, the talents and characteristics which WASHINGTON possessed would have been of the greatest value. That he was called from such a field by the necessities of war, and later by the unanimous recognition by the people of his fitness for managing affairs of State, does not lessen our obligation to recog-

nize him as one of the earliest members of the profession in this country.

It should inspire us to emulate his example and to endeavor to make ourselves worthy of the wonderfully beautiful and apt characterization of him by the poet WHITTIER, as

"The one man equal to his trust;
Wiser than lore, and without weakness good.
Calm in the strength of unflawed rectitude."

Montana Society of Civil Engineers.—At the monthly meeting held at Helena, Mont., in April, Mr. DANSE gave an interesting talk on the subject of fireproof buildings, illustrating his remarks by blackboard sketches.

The law regulating steam boilers, as passed by the last Legislature, was discussed and a number of defects therein were pointed out. Mr. ROBINSON promised to address a communication on the subject to the Society at the next meeting, and at that meeting Mr. KNIGHT, of Butte, will present a paper on "The Law of the Apex."

American Institute of Electrical Engineers.—The annual meeting will be held May 21 and 22 at the house of the American Society of Civil Engineers, 127 E. 23rd St., New York. The following papers will be read: "Modern Views as the Nature of the Electric Current," by Prof. H. A. ROWLAND, of Johns Hopkins University; "The Inherent Defects of Lead Storage Batteries," by Dr. LOUIS DUNCAN, of Johns Hopkins University; "Motor Regulation," by F. B. CROCKER; "The Measurement of Telephonic Currents," by Prof. CHAS. R. CROSS, of the Massachusetts Institute of Technology; "The Relation Between the Initial and Average Efficiency of Incandescent Lamps," by W. H. PIERCE of the C. B. & Q. R. R.; "Some Results with Storage Batteries in Train Lighting," by ALEXANDER S. BROWN, of the P. R. R.; "Magnetism and its Relation to Induced Electromotive Force and Current," by Prof. ELIHU THOMSON: "The Efficiency of the Arc Lamp," by H. NAKANO, with an introductory note by Prof. E. L. NICHOLS of Cornell University; "The Personal Error in Photometry," by Prof. E. L. NICHOLS, and "The Spiral Coil Voltameter," by H. J. RYAN, of Cornell University.

RAILWAYS.

EAST OF CHICAGO—Existing Roads.

Napanee, Tamworth & Quebec.—A correspondent sends us the following:

Grading is now completed for a distance of about ten miles, and the remaining ten miles of the Tweed extension is under contract. The Salmon River bridge is completed, and the masonry of the abutments for the bridges across the east and west branches of the Moira river is completed. Surveys are completed, the plot is filed and the contract is let for the 7-mile link connecting with the Kingston & Pembroke railway at Harrowsmith. W. H. B. SHERWOOD is the Superintendent and WM. MANN is the Engineer-in-charge.

Pennsylvania.—It is reported that plans have been matured for the completion of a line from Richmond to Mt. Dallas, Pa., about 27 miles. The new road is projected to give the Cumberland Valley division of the system an independent connection with the main line. Surveys were made for the link many years ago. The work will require heavy grading and some tunneling.——Surveys are reported for a branch from New Lisbon, N. J., to Brown's Mills.

Johnsonburg.—This Pennsylvania road has just been completed from Johnsonburg, on the Philadelphia & Erie, to Clermont, the terminus of a branch of the Western New York & Pennsylvania road. The line was built in the interest of the latter company.

McKeesport & Belle Vernon.—Passenger trains are now running from McKeesport to Bunola, 14 miles.

Long Island.—It is expected that the 4-mile extension to Oyster Bay will be open for traffic by June 22. Plans for the station at Oyster Bay are finished and work will begin at once on the structure.

Canadian Pacific.—The Government proposal to vote $13,000 per mile subsidy for the Short Line from Harvey to Salisbury, N. B., 113 miles, was passed in the Canadian House but defeated in the Senate.

Pennsylvania, Poughkeepsie & Boston.—It is now stated that the Poughkeepsie Bridge syndicate intend to continue their line from Slatington, Pa., to the Susquehanna river at Harrisburg. The charter for the old South Mountain enterprise has been bought by W. W. GIBBS, HENRY C. GIBSON, ARTHUR BROCK, and others interested in the Poughkeepsie Bridge system.——The Harrisburg & New England Ry. Co., by DEFORREST BALLOU, its President, has filed a bill in equity to prevent the construction of the Pennsylvania, Poughkeepsie & Boston road from Portland, Pa., to Harrisburg.

Grand Trunk.—It is rumored that the campaign against Canadian lines which Senator CULLOM and his colleagues are carrying on, has caused this company to take time by the forelock and seek a route to tidewater outside the jurisdiction of Congress. It is proposed to buy or lease the Temiscouata Valley road, and from its terminus to build on down the St. John's valley to the coast.

Baltimore & Drum Point.—Work is to be resumed at once by contractors Rogers & Clement on the division in Calvert county and it will be ready for the rails in three months. Work in Anne Arundel county will be finished in about the same time.

Pittsburg & Western.—At the annual meeting of this company the following results of operations for the past year were announced:

Gross earnings	$2,243,756
Operating expenses and taxes	1,435,872
Interest	645,057
Surplus	$162,827

HENRY W. OLIVER was elected President in place of JAS. CALLERY, deceased.

Michigan Central.—The annual report of this company shows the following results of operations for the year 1888 as compared with the previous year:

	1888	1887
Gross earnings	$13,770,523	$14,164,490
Operating expenses and taxes	10,086,606	9,875,246
Net earnings	$3,683,917	$4,289,244

The system has now a total extent of 1,537 miles, of which 439 miles belong to the Canada Southern division. There are 157 miles of second track on the system, and sidings bring up the total extent of tracks to 2,124 miles.

The report of the locomotive department shows an average annual mileage per engine of 36,870 miles and an average cost of maintenance of $1,304.60. The mileage per ton of coal was 29.53 miles.

Louisville, New Albany & Chicago.—Right of way is being secured for new terminal facilities at Indianapolis, whose total cost is estimated at $200,000.

West Jersey.—A branch is contemplated from Riddleton Jc., via Alloway and Quinton to Salem, N. J.

Philadelphia & Reading.—A surveying corps said to be in this company's employ are at work on a line from Oxford, Pa., to Singerly, Cecil Co., Md, on the Baltimore & Ohio, about 15 miles. The line is supposed to be intended for an extension of the Quarryville branch of the Reading system.

Surveys are reported in progress for a line into the Lehigh Valley coal fields. It is said that contracts have been closed with the principal independent operators in that section by which the new line will secure a traffic of at least 2,000,000 tons per annum.

Evansville & Richmond.—On this Indiana road, 160 miles in length, 3,000 graders are now at work and it is intended to have the line in operation by January 1. Between Seymour and Elnora, 70 miles, it is expected that trains will be running by August 1.

St. Johnsbury & Lake Champlain.—At a special meeting of this Vermont company's stockholders, it was voted to issue 5 per cent. bonds to an amount not exceeding $20,000 per mile to refund the present indebtedness and improve the road.

Lackawanna & Southwestern.—This company has been chartered in New York and will succeed to the property and franchise of the Allegheny Central and the Lackawanna & Pittsburg Ry. companies.

Projects and Surveys.

Confluence & State Line.—A correspondent informs us that grading is in progress on this road, and it is expected that 20 miles from Confluence, Pa., to Friendsville, Md., will be completed by Aug. 1.

We have also received the following information from J. BAYARD HENRY, of Philadelphia, President of the company.

The surveys have been finished and contracts for construction let to Kennedy & Crossan. The length of the road is 50 miles, and it runs through a level country. There will be one bridge across the Youghiogheny river. Tracklaying will commence about Aug. 15, and the road be opened for business about Oct. 15. JAS. M. CRAWFORD, of Fox Chase, Philadelphia, is Chief Engineer.

Keeseville, Ausable Chasm & Lake Champlain.—The survey for this road, which is to run from Port Kent to Keeseville, N. Y., a distance of 5.43 miles, has been completed and a very favorable route is reported to have been secured. There will be a bridge about 300 ft. long across Ausable Chasm. It is stated that the Delaware & Hudson Canal Co. will supply the rolling stock and crews to run the trains. It is expected that the road will be completed by fall. E. K. BARBER, of Keeseville, is president.

Oneonta & Earlville.—Incorporated in New York to build a line of railway from a point on the Oneonta & Richfield Springs R. R., in Laurens, Otsego county, to a point in the village of Earlville, Madison county, a distance of 42 miles. Among the directors are: CHESTER L. HARRINGTON, and JAS. C. POTTER, of HARTWICK; A. C. COUCH, of Bridgewater, and A. H. FIELD, of New York.

Mount Jewett, Kinzua & Riterville.—Incorporated in Pennsylvania to build a railway from Mount Jewett to the junction of the New York, Lake Erie & Western R. R. near Crofford's Summit, a distance of about 8 miles. Among the incorporators are: THOS. L. KANE, D. T. HALL, and J. D. MARTIN, all of Kane, Pa. ELISHA K. KANE, is President.

Rome & Carthage.—The surveyors of this road are making good progress. They are now working north from Point Rock and report a favorable route so far. The road is projected to run from Rome to Carthage, 56 miles. A. C. KESSINGER, of Rome, N. Y., is interested.

Kokomo Belt.—J. C. BLACKLIDGE, of Kokomo, Ind., is President; GEO. P. WOOD, Vice-President, and L. J. KILPATRICK, Secretary and Treasurer of this company which proposes to build a belt line of railway around Kokomo.

Nipissing & James Bay.—A correspondent sends us the following:

Mr. J. C. BAILEY, M. Inst. C. E., Chief Engineer of the Nipissing & James Bay Ry. Co. has just finished an exploration of the route of the proposed line from Lake Nipissing to Lake Temiscamingue. He was accompanied on the trip by Mr. M. J. BUTLER, M. Am. Soc. C. E., whose duties were to examine into the timber, agricultural and mineral resources of the district. The trip was made wholly on snow shoes, and the supplies were hauled on toboggans. In six weeks a distance of 350 miles was covered. The resources of the district were quite a surprise. It has been supposed to be a rough, rocky, mountainous and barren country, but it was found to contain a very large percentage of first rate land, and an enormous quantity of fine red and white pine, tamarack, spruce, black birch, and other timber. The soil is generally a clay loam. Near the head of Lake Tamagaming, copper, iron, and argentiferous galena, all in good paying quantities, have been found. Moose, caribou, and red deer were plentiful, as were beaver, otter, marten, fox, mink and the fisher among fur-bearing animals. The lakes abound in trout, whitefish, etc., so that on the whole the place is a sportsman's paradise.

Penobscot Central.—The town of Corinth, Me., has voted 5 per cent of its valuation, amounting to $71,950, in aid of this enterprise. This road was projected to run from Bangor to Milo, on the Bangor & Piscataquis R. R., a distance of 40 miles. The line was surveyed in 1887, and some local aid obtained from towns along the route, but the enterprise was allowed to drop, and little has been heard of it until the present time.

Cincinnati & Ohio River.—The officers of this company, whose incorporation was noted in our last issue are: E. C. DAWS, President; C. B. MATTHEWS, Vice-President, and CHARLES M. HEPBURN, Secretary; all of Cincinnati, O., where the general offices of the company will be located.

Oneonta & Richfield Springs.—A project to extend the New Berlin branch of this proposed road to Syracuse, N. Y., about 80 miles, is being discussed. A company has already been incorporated to build 42 miles of this distance by the name of the Oneonta & Earlville R. R. Co. A. C. COUCH, of Bridgewater, is President of both companies.

Washington & Sandy Springs.—Chartered in Maryland to build a narrow gauge road from Sandy Springs, Montgomery county, to Washington, D. C., by HENRY M. BAKER and A. G. M. PROVOST, of Washington, and others.

Vincennes, Oakland City & Owensboro.—The contract for building this proposed Indiana road has been let to JOSHUA D. POWERS, of Owensboro, who is to take bonds and stock in payment for the construction. It is reported that President RUDD is dissatisfied with the award and claims that a lower bidder offered to complete the line in one year, whereas Mr. POWERS only agrees to finish it in two.

SOUTHERN.—Existing Roads.

South Bound.—MIKE BROWN, of Barnwell, S. C., President of this company, is in New York City, to raise funds for the completion of the line. About 40 miles, from Barnwell to Seivern, S. C., is now in operation, and it is intended to extend the road north to Columbia, and south to Savannah, making a total length of about 140 miles. About $150,000 local aid has been secured.

Green Pond, Walterboro & Branchville.—Work will soon begin on a 12-mile extension to Barnwell, S. C.

Florence Northern.—About 13 miles of grading are finished, cross-ties are being distributed along the line, and negotiations for rails are in progress.

Central R. R. of Georgia.—On the Buena Vista extension between Columbus and Americus, Ga., tracklaying is about completed. It is stated that the company has just floated a bond issue of $8,500,000 through the banking house of Kuhn, Loeb & Co., the proceeds to be used for the construction of the Savannah & Western lines as originally contemplated.——Grading will begin at once for double tracking the 6 miles between Atlanta and East Point, Ga.

Savannah, Americus & Montgomery.—The company has issued a mortgage for the sum of $4,100,000 to the Mercantile Trust Co., of Baltimore, to secure a bond issue of like amount. The funds raised are to be used in extending the line east toward Savannah and west to Montgomery, Ala.

Atlantic & Danville.—Tracklaying on the division from Danville, Va., east has been resumed.

Alabama Midland.—About 2,000 hands are now at work on this road. About 25 miles of track have been laid. The tracks of the Northwest & Florida roads being widened to standard gauge.

Kentucky Union.—Right-of-way has been secured for the section between Winchester and Lexington, and grading is to begin at once. Tracklaying began this week on the section between Winchester and Hedges.

Covington & Macon.—It is reported that the contract for the branch to Griffin, Ga., about 50 miles in length has been let to R. T. Martin & Co., of Chattanooga, Tenn.

Lexington Belt.—Contracts have been closed for nearly all the right of way required for this road, which is to encircle the city of Lexington, Ky. CHAS. H. STOLL is President and A. I. TOTTEN is Chief Engineer.

West Virginia Central.—The extension to Elkins W. Va., will be completed about July 1.

Columbia, Newberry & Laurens.—The contract for the completion of this South Carolinia road from Columbia to Newberry, S. C., 42¼ miles, has been let to the Congaree Construction Co., of which WM. H. LYLES, Columbus, S. C., is President. About 21 miles are already graded.

The contract for 120,000 ft. B. M. of trestling has been let to Rice & Coleman. The whole line is to be completed equipped, and turned over to the railroad company by May 1, 1890. CHAS. ELLIS Jr., of Columbia, S. C., is Chief Engineer.

Georgia Pacific.—A short branch is projected from North Birmingham to Coalburg, Ala.

Projects and Surveys.

Weston & Elk River.—Engineers will begin the survey of this road, which is projected to run from Weston, W. Va., to Sutton, W. Va., a distance of 3 miles, at once. JOHN BRANNON is President, and N. B. NEWTON is Secretary; both of Weston.

Rogers & Summit.—Chartered in Georgia to build a line of railway from Rogers, Burke county, to Reidsville, Tattnall county, a distance of 50 miles. Among the incorporators are: O. WADLEY, WM. M. STEVENS, J. W BOWIE, and ROSWELL M. KIMBALL.

Alabama Timber & R. R. Co.—This company is making arrangements to build a line of railway from Jasper, Ala., north about 15 miles, to their timber lands.

Kansas City, Chattanooga & Port Royal.—Incorporated in Tennessee by W. C. SMITH, of Wallview, Tenn.; J. C. WALL, of Stevenson, Ala., and others, to build a railway to some point on the Mississippi river.

Blue Mountain Mineral.—J. A. GABOURY, of Jacksonville, Ala., Chief Engineer, writes us as follows:

The survey for this road, which is to run from Anniston, Ala., via Jacksonville to a junction with the East & West R. R. of Alabama, a distance of 20 miles, will be completed by May 10. The route is through a broken mountainous country. The maximum grade is 1¼ per cent, and the maximum curvature is 6°. There will be two iron bridges of about 50 ft. span. The principal business will be in the transportation of iron ore, manganese, sand stone, lime stone, charcoal and timber. The right of way has been obtained and other local aid to the amount of $150,000 secured. Other capital for construction will be secured by the issue of bonds at the rate of $12,000 per mile. Contracts for construction will be let about June 1. Tracklaying will begin about Sept. 1, and it is expected to have the road open for traffic one month later. JAMES CROOK, of Jacksonville, is President.

Chicago, Parkersburg & Norfolk.—This company has issued first mortgage bonds to the amount of $10,000,000, to the Mercantile Trust Co., of New York, and the mortgages are being recorded in the counties through which the road will pass. In the State of West Virginia 320 miles will be built from Parkersburg directly east to the Virginia State Line.

Anniston & Northeast Alabama.—Incorporated in Alabama to build a railway from Anniston to Alpine, Ga., about 60 miles. Among the incorporators are ROBERT LAWRENCE, of Cedar Bluff; R. A. RUSSELL, of Gaylesville; J. W. HARRIS, of Piedmont, and WM. NOBLE, of Anniston.

THE NORTHWEST.—Existing Roads.

Pacific Short Line.—E. P. Reynolds & Co., who have the contract for grading the first 100 miles of this road, have sublet a portion of the work as follows: Brooks & McLean, of Denver, 10 miles; McNamara & Kimball, of Sioux City, 11 miles; T. McCarthy, of Sioux City, 4 miles; Miles Naughton, of Sioux City, 4 miles; Smith & Cordon, of Cherokee, Ia., 2 miles, and John Fleming, of Omaha, 2 miles. The general contractors will do a portion of the work themselves.

Chicago, Burlington & Quincy.—It is stated that the Burlington & Missouri River R. R. will soon complete the road from Culbertson, Neb., to Holyoke, Colo., 84 miles. The road was graded ready for the rails two years ago, but nothing further has been done. It is expected that work will commence at once.

Des Moines & Fort Dodge.—The Railroad Commissioners of Iowa have made a decision in the case of the City of Fort Dodge against the above company, which built, and the Chicago, Rock Island & Pacific R. R. Co., which operates, the road from Fort Dodge to Des Moines. They order the Des Moines & Fort Dodge Co. to rebuild their road between Tara Station and Fort Dodge, by restoring the roadbed, replacing the bridges and relaying the rails. The work of reconstruction shall begin not later than June 15, 1889, and the road shall be completed by November. Pending the completion of the work the C., R. I. & P. is to run one passenger and one "mixed," freight and passenger, train daily between Fort Dodge and Des Moines. As the Des Moines and Fort Dodge Co. is bankrupt, there will probably be considerable litigation before the order is enforced.

Duluth, Red Wing & Southern.—The first division of this Minnesota road, between Red Wing and Zumbrota, 25 miles was opened for business on May 7. We acknowledge receipt of an invitation to an excursion over the line on that date.

Projects and Surveys.

Sioux Falls & Northwestern.—A company by this name is to be incorporated to build a railway from Sioux Falls to Aberdeen, Dak., a distance of about 165 miles.

Sioux Falls & Pacific Short Line.—Incorporated in Dakota to build a line of railway from Sioux Falls, Dak. to Eagle Rock, Idaho. Among the incorporators are: WM. VANESS, W. E. WILLEY, and G. M. CUSHING, all of Sioux Falls.

Litchfield, Carrollton & Western.—This company has been incorporated in Illinois to build a line of railway from Litchfield to Quincy, a distance of about 95 miles. Among the incorporators are: ORNAN PIERSON, of Carrollton; JOHN N. ROBERTS, of Clarksville, and MARCUS HOOK, of Jacksonville.

Peoria, Springfield & St. Louis.—Chartered in Illinois to build a railway from Springfield to East St. Louis, a distance of about 87 miles. Among the incorporators are: E. S. GREENLEAF, W. W. KENT, and WM. S. HOOK.

THE SOUTHWEST.—Existing Roads.

Austin & Northwestern.—This road, which runs from Austin to Burnet, Tex., 60 miles, is to be changed to standard gauge.

Texas Grand Trunk.—The citizens of Palestine, Tex., have subscribed $35,000 of stock in aid of this enterprise. Negotiations for right of way and depot grounds through the county are in progress.

Missouri Pacific.—It is reported that this company will shortly begin work on an extension from Lincoln, Neb., via Hastings and Kearney to the Wyoming coal fields.

Houston & Texas Central.—Suits have been filed against this company by the Lackawanna Coal & Iron Co., for notes given in payment for rails furnished the company and used in the betterment of its road; by the Southern Development Co. of San Francisco, to recover $845,864.07 loaned the defendant, and by Morgan's Louisiana & Texas R. R. & Steamship Co., for notes held by them amounting to $1,343,518.53. The aggregate claimed in the three suits is $2,704,585.10.

Kansas City, Texarkana & Gulf.—A press report states that an offer has been made by certain capitalists to build this line on condition that a bonus of $40,000 be raised by the people along the route. The road was projected to run from Texarkana, Ark., north to Kansas City, Mo., and south to Sabine Pass., Tex. In 1887 10 miles from Texarkana north were built, when work was stopped for want of money. The road then passed into the hands of J. F. HINCKLEY, of Chicago, who claimed to represent a syndicate of Eastern capitalists; but no work was done, and he surrendered the securities given him and dropped the project a short time ago.

San Antonio & Aransas Pass.—Work is being pushed on the extension of this road from West Point north via Giddings, Rockdale, and Cameron to Fort Werth.—It is stated that engineers will be put into the field to locate the extension from Kennedy Junction to Laredo immediately, and that the road will be completed in 12 months.

Kansas City, Wyandotte & Northwestern.—Contracts for extending this road from Summerville, Kan., to Beatrice, Neb., are reported let.

Projects and Surveys.

Golden Lake & Frenchman's Bayou.—P. A. BARTON, of Golden Lake, Ark., President of this company, sends us the following information concerning the enterprise:

Our project is at present to build a tramway from Golden Lake to Walnut Grove, 6 miles, with the intention of continuing it via Glendale to Gilmore, on the Kansas City, Fort Scott & Memphis R. R., 14 miles more. The road follows the public highway through a flat bottom land, crossing several sloughs and entering one of the finest timber regions in the State. The principal business will be the transportation of logs to our saw mill and general traffic in cotton and other farm produce. The surveys will begin at once and construction will follow closely. The road will be laid with wooden rails capped with ⅝-in. or ½-in. bar iron. We expect to have the first 6 miles completed by Sept. 1.

Louisiana, Arkansas & Missouri.—Chartered in Arkansas to build a line of railway from Brinkley through the counties of Monroe, Drew, Lincoln, and Chicot to the Louisiana State line, a distance of 150 miles. HARLOW M. HOYT, of New York, is interested.

Dunklin County & Memphis.—This company has filed articles of incorporation in Missouri to build a railway from Malden, Mo., to Memphis, Tenn., about 100 miles. The officers of the company are: G. W. SIGNOR, President; J. L. REINACH, Secretary, and JAS. M. WALTRIN, Treasurer.

Sulphur Springs & Cooper.—It is stated that subsidies amounting to $55,000 have been secured in aid of this road, and that work will begin at once. The road is projected to run from Sulphur Springs, Tex., to Cooper, Tex., a distance of about 16 miles. G. B. BOOMER, of Rochester, N. Y., is interested.

People's.—Incorporated in Kansas to build a railway from a point near Garnett, in Anderson county, northwest to Topeka, about 125 miles. The officers are L. C. ALEXANDER, of Kansas City, President; F. G. WELCH, of Williamsburg, Vice-President; T. ORMSBY, of Topeka, Secretary, and C. SPAULDING, of Topeka, Treasurer.

Central Arkansas.—H. J. CAMPBELL, Chief Engineer, is at work on the locating surveys of this road which is to run from the present terminus of the Pine Bluff & Swan Lake R. R. to Little Rock, Ark., with a branch to some point on the Mississippi river. A. C. BARSTOW, of New York, is President.

Ouachita, Union & Northwestern.—This company has been organized in Louisiana to build a railway from a point near Vidalia, via Monroe and Farmerville to Camden, Ark., about 150 miles. URIAH MILLSAPS is President and W. W. HEARD is Vice President; both of Monroe, La.

Kansas City Incline Plane Co.—A company has been incorporated in Kansas City, Mo., to build an incline railway from High Street to Freight street, about 600 ft. LOUIS C. IRVINE, is interested.

ROCKY MT. AND PAC.—Existing Roads.

Southern Pacific.—A press dispatch from San Antonio, Tex., states that the Southern Pacific has purchased the Rio Grande & Eagle Pass R. R., which runs from Laredo to Santa Tomas, 27 miles, and will extend it from Laredo to Eagle Pass, about 108 miles, and from Laredo to Brownsville, about 180 miles.—The extension from Victoria via Beeville to Laredo is being pushed forward rapidly.

Union Pacific.—S. BAMBERGER, of Salt Lake City, Utah, has the contract for grading the extension of the Salt Lake & Western R. R., from its present terminus to Eureka, Utah. It is expected that the extension will be completed by June 10.

Oregon Railway & Navigation Co.—A loop line is to be built, running from Tekoa to a point on the main line to be called Winona Junction. The object of the loop is to furnish a line with easier grades for freight traffic.—About 1,400 men are at work on the line from Farmington to the Coeur d'Alene reservation.

Projects and Surveys.

Marysville, Sutter City & Colusa.—A press report states that the locating surveys for this road, which is projected to run from Marysville, Cal., to Colusa, Cal., will commence soon, and grading will begin immediately after the survey is completed.

FOREIGN.

Japan.—The railway between Shisnoka and Hamamatsu, 46 miles in length, was opened for traffic April 16. A railway has been surveyed from Mochaski to Niggata, a distance of 189 miles, and another is projected to run from Maisuru to Shikowa.

Sierra Madre & Laredo.—It is stated that a company is trying to obtain concessions from the Mexican Government to aid in building a railway from the Sierra Madre mining districts to Laredo, Tex., a distance of 140 miles. The road would obtain a large business from the mines along the route.

Mexican Central.—The annual report of this company for 1888 shows the following results from operations as compared with the previous year:

	1888	1887
Gross earnings	$5,774,331.31	$4,888,578.67
Operating expenses	3,418,837.56	2,717,452.72
Net	2,355,493.75	2,171,125.95

About 100 miles of new road have been completed since the last report and the present mileage is 1,631. The only construction now going on is upon the Tampico Division. The entire length of this division is 400 miles, of which 212 miles have been completed, and work is being rapidly pushed on the remainder.

New Zealand Midland.—This company has made an issue of $3,650,000 of 5 per cent. bonds to aid in the construction of its line. The company was incorporated Jan. 17, 1885 and in August 1888, securing by the last act additional advantages. The Government has subsidized the company by a grant of 2,000,000 acres of land, which it may select at option and in case the present grant should not bring in $6,125,000 to the company, additional land shall be granted to bring up the receipts figure. The road will connect the east and west coasts of the southern Island and will afford through communication between Christchurch, and the harbors of Greymouth and Nelson. The road from Brunnerton to Kaimata, in the timber district, and from Stillwater to Nelson, in the mineral district, in all about 15 miles, has been completed. The present issue of bonds is to be used to extend and equip the line to Reefton, about 40 miles; to build 12 miles in the timber district, and about 12 miles of extensions at Greymouth and Christchurch, in all 64 miles. The Chief Engineer is ROBERT WILSON, 7 Westminster Chambers, S. W., London, and the Secretary is ÆNEAS R. MCDONNELL, 79 Gracechurch St., E. C., London.

RAPID TRANSIT.

Electric Railways.—***Bangor, Me.***—The first car was run over the new line on April 28.

Troy, N. Y.—The Troy & Lansingburg Ry. Co. has contracted with the Thomson-Houston Electric Co. for the equipment of a line from Troy to Lansingburg and Waterford.

Knoxville, Tenn.—The Riverside Electric Street Ry. Co. has been incorporated by J. M. BROOKS, W. A. PARK, G. W. ARTHUR, and others, to build a line 5 miles long

Capital stock, $100,000. Propositions were to be received by G. W. ARTHUR up to May 10.

Spartanburg, S. C.—A franchise for an electric railway to Clifton has been granted to a company headed by A. H. LEFTWICH, of Greensboro, N. C.

Greenville, S. C.—The Greenville Street Ry. Co. proposes to adopt electric traction.

Americus, Ga.—A contract for the equipment of the street railway has been awarded to the Thomson-Houston Electric Co.

Milwaukee, Wis.—The Milwaukee Cable Ry. Co. is said to intend using electric instead of cable traction.

Stillwater, Minn.—Tracklaying is in progress for the electric railway.

Yankton, Dak.—A franchise for an electric railway 1¼ miles long has been granted to R. F. PETTIGREW, of Sioux Falls.

Waterloo, Ia.—The street railway company has decided to adopt an electric system of traction.

Omaha, Neb.—The Council Bluffs & Omaha electric line is being extended. Additional plant of 2 200-H. P. engines, 4 boilers and 4 dynamos is to be put in.

Seattle, Wash. Ty.—The electric railway may be extended to Lake Washington.

Modesto, Cal.—It is proposed to build a line to be operated on the Euphrat electric system.

Gainesville, Tex.—The Fort Worth Loan & Construction Co., of Fort Worth, has purchased the street railway; it will be extended to 10 miles in length and be operated by electricity.

San Antonio, Tex.—The Fort Worth Loan & Construction Co. has bought the street railway and will equip it for an electric system.

Street Railways.—*Syracuse, N. Y.*—The contract for the construction of the Eleventh Ward street railway has been awarded to T. Wm. Harris & Co., of New York.

Staunton, Va.—The Staunton Improvement Co. will build a street railway and will soon be in the market for rails and cars.

Bowling Green, Ky.—The Park City Street Ry. Co. has commenced work and will purchase equipment.

Memphis, Tenn.—The Memphis & Fort Pickering Ry. Co. has applied for a street railway franchise. LOUIS HANAUER is interested.

Columbia, S. C.—The Philadelphia company which owns the street railway will extend and improve the road, or will sell out to a local company. Capt. J. D. STARLING is the manager.

Duluth, Minn.—The Duluth Street Ry. Co. will build a line on 4th St., and will have it in operation by August.

Atchison, Kan.—The Atchison Street Ry. Co. is reported to intend expending $20,000 in improvements.

Denver, Col.—The University Park Ry. Co. is open to receive bids for grading and tracklaying; also for furnishing all materials, rails, ties, cars, etc. President, MILO A. SMITH; Secretary, S. G. COLLINS.

Salt Lake City, Utah.—A petition for a franchise for a street railway aggregating 20 miles in length, with power to use horse, steam or electric traction, has been applied for by J. T. LITTLE, A. H. CANNON, L. S. HILLS, and P. L. WILLIAMS.

Albany, Ore.—The Albany Street Ry. Co. has let the contract for building the line to W. E. Kelly, of Albany, at $4,200 for 4,000 ft. of track complete and ready for the rolling stock, the contractor furnishing everything. Mr. C. G. BURKHART is secretary of the company.

Tacoma, Wash. Ty.—The syndicate headed by Mr. HENRY VILLARD, of the Northern Pacific, which purchased the franchise granted to NELSON BENNETT two years ago, has been granted a 50 years' franchise. Cable and electric lines may be built.

Terrell, Tex.—A street railway will be built by W. A. DISBOROUGH or D. J. ANTHONY.

Cable Railway.—*Seattle, Wash. Ty.*—The Front St. Cable Ry. Co. will extend its line about two miles north if a subsidy is granted. The extension will be operated by a separate cable, driven by the present plant. The cost will be $125,000.

Los Angeles, Cal.—The Cable Ry. Co. is contemplating several extensions. Mr. A. W. WRIGHT, of Chicago, is the engineer, and Mr. J. C. ROBINSON, the superintendent.

Riley Elevated Railway.—The Riley Elevated Ry. Co. will build about 1 mile of road at Revere Beach, Mass., for summer traffic. It will be operated by electricity.

Storage Battery Motor.—*New Orleans, La.*—The Gibson storage battery electric motor is running on the St. Charles St. line. It has a capacity for 40 passengers.

Dummy Lines.—*Concord, N. C.*—The Concord Ry. Co. will build a dummy line 2 miles long; 40-lb. rails will be used.

Augusta, Ga.—The Augusta & Fairmont Ry. Co. has been chartered and proposes to build a dummy line.

Lindall, Ga.—A company is being organized by MOSES DANIELS to build a dummy line to Rome.

Birmingham, Ala.—The Birmingham, Powderly & Bessemer Ry. Co. has decided to issue bonds for $100,000 to build its dummy line. A meeting will be held May 25 to discuss the question of increasing the capital stock to $250,000.

Anniston, Ala.—The Oxford & Minnelulah Lake Ry. Co. has let the contracts for its dummy line to George Harris for grading, and F. Larned for bridge and trestle work.

Decatur, Ala.—The New England Building & Improvement Co., of Vergennes, Vt., will build a dummy line about 6 miles long from Decatur to Moulton Heights and Trinity. E. T. HEALEY, of Decatur, is General Manager.

Kansas City, Kan.—A company has been organized to build a dummy line from Chelsea Park to Quindaro.

Port Townsend, Wash. Ty.—Work is in progress on Mr. DOOLEY'S motor line. Rails and cars have been shipped from Detroit.

Denison, Tex.—The street railway has been purchased by parties who will operate it by dummies.

Thomson-Houston Electric Railways.—*Salem, Mass.*—The company has contracted to supply the Naumkeag Street Ry. Co. with 6 motor trucks, each equipped with two 15 H. P. motors. They will be used on the line from Salem to the Willows.

East Harrisburg, Pa.—The company has received an order from the East Harrisburg Passenger Ry. Co. for one double motor truck, equipped with two 15 H. P motors.

Revere, Mass.—Work on the new line is being rapidly pushed toward completion, and the track is nearly all laid. The line is double track and will extend from Winthrop Junction to Crescent Beach, and may be continued beyond there on the tracks of the West End Street Ry., of Boston.

CONTRACTING.

Hall.—The contract for the Mechanical Hall on the grounds of the Western Pennsylvania Exposition Society, at Pittsburg, has been awarded to the Marshall Foundry & Construction Co., of Pittsburg, at $115,000. The building will be 300 ft. long and 135 ft. wide, entirely of iron and glass. JOSEPH STILLBURG, of Pittsburg, is the architect.

Pipe.—The contract for pipe and specials has been awarded by the Water Board, Boston, Mass., to the Gloucester Iron Works, Philadelphia, Pa., at the following prices: 4-in. (B), $28.43 per gross ton; 6-in. (B) and 8-in. (B), $28.31 per ton; 12-in. (A and B), and 16-in. (A and B), $27.55 per ton; 20-in. (A and B), $27.45 per ton; specials, $53.20 per ton; total, $96,135.05. The other bidders were: Warren Foundry & Machine Co., Phillipsburg, N. J., $98,727.50; R. D. Wood & Co., Philadelphia, Pa., $99,232; McNeal Pipe & Foundry Co., $100,435; Mellert Foundry & Machine Co., Reading, Pa., $101,323. The quantities are as follows: 35 tons of 4-in., 750 tons of 6-in., 350 tons of 8-in., 100 tons of 12-in. (A), 200 tons of 12-in. (B), 200 tons of 16-in. (A), 330 tons of 16-in. (B), 180 tons of 20-in. (A), 1,270 tons of 20-in. (B); 25 tons of specials.

Gas Pipe.—The Chester Pipe Co., of Chester, Pa., has a contract for 40 miles of 8-in. pipe for the Saltsburg Natural Gas Co.

Street Sprinklers.—Studebaker Bros., of South Bend, Ind., have a contract to furnish Pittsburg, Pa., with three 2-horse street sprinklers, with a capacity of 750 galls. each, at $385 each; and one 1-horse sprinkler, with 2 attachments, at $325.

Cement.—The Department of Awards, Pittsburg, Pa., has awarded a contract for cement to the Pennsylvania Mfg. Co.

Rip-Rap.—At Springfield, Mass., the following bids have been received by the Harbor Commissioners for 4,000 yds. of stone for riprapping on the Connecticut river bank in Hadley. William P. Latham, of Northampton, $1.99 per cu. yd.; George M. Atkins, of Palmer, $2.34; R. F. Underwood, of Easthampton, $2.40; F.M. Cook & Sons, of Northampton, $3.20; John Landy, of Northampton, $4. The contract was awarded to William P. Latham for $1.99 per cu. yd.

Filling.—The Aqueduct Commissioners, New York City, have awarded the contract for filling around the gate-house, to Smith & Brown, contractors for Section No. 1, at 50 cts. per cu. yd. for 6,800 cu. yds.

Sewers.—*Duluth, Minn.*—The following proposals for a sewer on Michigan St., between 13 and 24th Aves., have been received by the Board of Works: F. L. McDonald, $25,082.75; Wolf & Truax, $30,357.30; J. C. Morrison, $32,246.70; Zimmerman & Moore, $32,933.75; McArthur Bros., $33,873.23; Fred Youngren, $40,853.36. The award was made to F. L. McDonald.

Rockford, Ill.—The following proposals were opened April 22 by E. K. CONKLING, City Clerk: Sewer on Court St.: T. J. Mellon, of Rockford, $2,512.50; Rockford Construction Co., $3,304.75; A. Benner, of Indianapolis, Ind., $3,808.50; J. M. Peter, of Cincinnati, O., $3,837.85. Sewer on Chestnut St.: T. J. Mellon, $3,913.25; Rockford Construction Co., $4,382.85; A. Benner, $5,086.20; J. M. Peter $6,280.07. Both contracts were awarded to T. J. Mellon.

Street Work.—*Rome, Ga.*—A movement is on foot for the paving of the principal streets with Belgian blocks.

Muluth, Minn.—The contract for paving West Michigan St., between 15th and 24th Sts., has been awarded to G. A. Libly at $25,120, using Berea curbing.

San Antonio, Tex.—The city has voted to issue $250,000 in bonds for street improvement. PAUL PRETZER is City Engineer.

Montreal, Canada.—The Road Committee has awarded contracts as follows: Flagstone crossings: Jas. Cochrane, 14 cts. per lin. ft. Hauling and laying stone block paving on 6 ins. of concrete, with 1 to 1 cement grouting: F. H. McKenna, $1.59 per sq. yd. Granite block: 10 x 3½ x 6 ins., Jas. Cochrane, $2.20 per sq. yd. Crosswalk flags: F. D. Laurence, 73 and 92½ cts. per lin. ft. Stone curbing: Desormeault Frères, 55 and 60 cts. per ft. for straight and curved. F. D. Laurence, laying curbing, 17 cts. per lin. ft.; taking up and relaying curbing, 13, 15, and 33 cts. per lin ft.; flagstone sidewalks, 25, 32, and 55 cts. per sq. yd.

Brazil, Ind.—The Board of Commissioners of Clay county have let the contract for laying the stone sidewalk in front of the court-house grounds to Puttmann & Lloyd, at 34½ cts. per sq. ft., the flags to be of Decatur county limestone, 12 ft. in length, from 3½ to 6 ft. in width, and 6 ins. thick, to be completed by the first day of June. The length of the walk is about 275 ft., making a total of 3,300 ft. of surface, costing in round figures $1,100.

Asphalt Paving.—On March 12, the Executive Board, of Rochester, N. Y., opened bids for asphalting 27,000 sq. yds., on Lake Ave. The net bids were: Rochester Vulcanite Paving Co., for a vulcanite pavement, $77,950. Henry Bolze, New York, for a Sicilian rock asphalt pavement, $83,498.26. A majority of the property owners on Lake Ave. were in favor of the Sicilian rock asphalt, which has given great satisfaction on Brown and Gorham Sts., Rochester, and after much deliberation the contract was, on April 29, finally awarded to Henry Bolze. The sub-contract for grading has been let to Whitmore, Rauber & Vicinus.

PROPOSALS OPEN.

Street Railway.—Grading trestles, etc. Major SEARS, Chief Engineer, Metropolitan Ry. Co., Portland, Ore.

Sewer Work, Stone, Etc.—Sewers and receiving basins; 2,300 cu. yds. of broken stone and 1,100 cu. yds. of trap-rock screenings; 2 hydraulic elevators; repairing steps, etc., of City Hall. THE COMMISSIONER OF PUBLIC WORKS, 31 Chambers St., New York City. May 14.

Street Work and Street Railway.—Regulating, grading, curbing, and flagging, granite block and concrete paving; also laying street railway tracks through Transverse road No. 3, Central Park. THE PARKS COMMISSIONERS, 49 and 51 Chambers St., New York City May 15.

Bridge.—Iron, wood, or combination low-truss bridge over Long Lake creek; 50 ft. long with 18-ft. roadway. R. R. MARCH, County Auditor, Bismarck, Dak. May 16.

Artesian Well.—Lump sum, no bid per ft. will be considered; prices for well 4, 5, and 6 ins. at bottom. P. SCHWELLENBACH, Steward, North Dakota Hospital for the Insane, Jamestown, Dak. May 16.

Building.—Enlargement of the Maine State Capitol. Plans and specifications at the office of Bingham & Spofford, 10 Milk St., Boston, Mass. C. S. HICHBORN, Secretary, Capitol Committee, Augusta, Me. May 16.

Water-Works.—Excavation and embankment and building 2 sections of the new low service conduit. HENRY FLAD, President Board of Public Improvements St. Louis, Mo. May 17.

Sewers.—Brick sewer 4 ft. diameter with 8-in. walls, 12-in. vitrified pipe, branches, manholes, etc. T. J. LANAHAN, Clerk of Board of Contract and Apportionment, Albany, N. Y. May 20.

Sewer Pipe.—About 6 miles of salt-glazed vitrified pipe. Also constructing sewers. CYRUS T. LANG, Borough Engineer, Greensburg, Pa. May 20.

Bridges.—Bridge with 4 spans of 141 ft. over Wabash river, bridge with 3 spans of 124 ft. over Eel river; roadways 20 ft. wide, with two 6 ft. walks; capacity 100 lbs. per sq. ft. for roadway and 60 lbs. per sq. ft. for footway. Plans and specifications to be furnished. Bids per lin. ft. THE COUNTY COMMISSIONERS, Logansport, Ind. May 21.

Bridge.—Over the Appalachie river. CHAS. W. BALDWIN, Madison, Ga. May 23.

Bridge.—Over the Tennessee river. THE COUNTY COMMISSIONERS of Hamilton Co., Chattanooga, Tenn. June 1.

Bridges.—Iron highway bridges, 2 of 166 ft., and 1 of 175 ft. span. A. M. VAN AUKEN, Chief Engineer, Massasoit Improvement Co., Opera House Block, Denver, Col. June 1.

Bonds.—Buckeye St. bridge bonds for $30,000, levee bonds for $50,000, fire department bonds for $50,000. H. E. BRYAN, City Clerk, Columbus, O. June 5.

Bridge.—Iron or combination, 1 span of 120 ft. and 1 of 50 ft.; 16 ft. roadway, no footwalk; capacity, 2,000 lbs. live load per lin. ft. J. C. COPE, Vernon, Ind. June 5.

Street Lighting.—Gas or electricity; to be in operation by October. A. P. JOHNSON, City Register, Lexington, Mo. June 10.

MANUFACTURING AND TECHNICAL.

Pipe Foundry.—A syndicate headed by A. H. KAUFMAN, of Sheridan, Pa., proposes to build an iron pipe foundry at some point on the Norfolk & Western R. R.

Cement.—The Howard Hydraulic Cement Co. has been organized at Cement, Ga., by GEO. H. WARING and F. H. WARING.

Steam Track Car.—The Ionia Steam Hand Car Co. (which has rather an anomalous title) has built a steam track or inspection car for Mr. JOHN DOYLE, Roadmaster of the Detroit, Lansing & Northern. A small upright engine drives the leading axle by a sprocket wheel and chain. Thetotal weight is only 700 lbs.

Locomotives.—TheRichmond Locomotive & Machine Works, of Richmond, Va., are building 2 consolidation engines for the Richmond & Danville.

The Pennsylvania road will soon, it is reported, place orders for 50 engines.

The San Antonio & Aransas Pass road will purchase 25 new engines.

The Augusta Brick Co., of Augusta, Ga., wants second-hand light locomotives,

Cars.—The Iron Car Co., of New York, is building for the Philadelphia & Reading 888 drop-bottom coal cars and 640 box-cars of 60,000 lbs. capacity.

The U. S. Rolling Stock Co. is building at its works at Hegewisch, Ill., 23 passenger and baggage cars for the Alabama Midland, and 150 ore cars for the Milwaukee & Northern.

The Gilbert Car Works, of Troy, N. Y., have completed 11 passenger cars for a Tennessee road, and have an order for 250 freight cars for South America.

The Jackson & Sharp Co., of Wilmington, Del., has recently built 6 passenger cars for the Richmond & Danville, 2 for the Ulster & Delaware, and 2 for the Allegheny Valley; also 2 passenger cars and 1 mail car for the Chateaugay road,

The St. Charles Car Co., of St. Charles, Mo., has turned out 2 parlor cars. An order for 500 freight cars for the Missouri Pacific is on hand.

The Litchfield Car Co., of Litchfield, Ill., is building box cars for the Texas & Pacific.

The Roanoke Machine Works, of Roanoke, Va., have an order from the Norfolk & Western for 100 box cars of 30,000 lbs. capacity.

The Pullman Palace Car Co., of Chicago, has built 4 sleepers for the New York, Philadelphia & Norfolk.

The Pennsylvania road will add 150 passenger cars and 2,000 freight cars to the equipment on the lines east of Pittsburg.

The New York, Lake Erie & Western will soon place orders for 200 box cars.

Supplies.—Cornell, Hiscox & Underhill, of 13 Gold St., New York, are manufactures of and dealers in pipe, hydrants, fittings and supplies of all kinds for railways, mills, mines, furnaces and contractors.

Water Columns.—The Reliance Gauge Co., of Cleveland, O., reports several orders for its safety water columns, including second and third orders from parties already using these columns.

Cattle Guards.—The National Surface Guard Co., of Chicago, Ill., has recently received orders from several roads for an aggregate of 350 guards. All these orders have been placed after trials of sample guards, which have been found more efficient and durable than the old style of pit guard. They are said to cost less than the average pit guard.

Locomotives and Cars for Sale.—RUFUS MARTIN, 15 Broad St., New York, has for sale 2 Baldwin motors, 10 x 14-in. cylinders, 30,000 lbs. weight; also 6 second hand closed and 4 open suburban passenger cars, standard gauge. The cars were built by the J. G. Brill Co, and are fitted with the Eames brakes; the closed cars are 26 ft. long, 32 ft. over platforms, 7 ft. 3 ins. wide, 10,000 lbs. weight, seating capacity for 40; the open cars are 34 ft. long over platforms, 7 ft. 6 ins. wide, 9,700 lbs. weight, seating capacity for 70.

Servis Tie Plates.—The Dunham Mfg. Co., of Boston, Mass., reports sales to a number of roads during the past few weeks. The company is also doing a large business with its patent doors for freight cars.

The Urie Dredge Mfg. Co., of Kansas City, Mo., reports orders on hand to keep the works busy for a considerable time.

Cable Grip.—A company has been organized to control the patents of the Terry cable grip. Capital stock, $1,000,000. The incorporators are S. H. TERRY, of St. Louis, Mo.; M. M. BROADWELL, of Kansas City; EDWARD CURD, of Fulton, Mo.; J. MONTGOMERY, and GEORGE JACKSON, of Sedalia, Mo., and A. W. NESBIT, of Pomona Cal.

War Ships.—The Union Iron Works, of San Francisco, Cal., which are building the *Charleston* and *San Francisco*, have the contract for the armored harbor defense vessel. The contract for the machinery for the *Texas* has been awarded to the Richmond Locomotive & Machine Works, of Richmond, Va.

The Illinois Steel Co. has been organized by the consolidation of the North Chicago Rolling Mills Co., the Union Steel Co., and the Joliet Steel Co. Capital stock, $25,000,000.

The Car Wheel foundry of the Lafayette Car Works, Lafayette, Ind., was burned recently, causing a loss of $10,000.

The Pacific Contracting Co. has been organized at San Francisco, Cal., by CLARENCE D. VINCENT, SYLVESTER TRULL and E. J. MARTIN. Capital stock, $100,000.

The Argentine Steamship Co. has been organized at Ashland, Ky., by FRANCISCO COMAS, HENRY C. RILEY, and RICHARD COPP, to operate a line of steamers between New York and Buenos Ayres.

Dry Dock.—A floating dry dock is to be built at Mobile, Ala., by James Flock, at a cost of $30,000. It will be 200 ft. long, 70 ft. wide and 9 ft. deep, and will accommodate vessels of 4,000 tons, 225 ft. long on the keel, and 20 ft. draught. There will be 4 pontoons 60 ft. long, 20 ft. wide, and 5 ft. deep.

The Potomac Steam Sand Dredging Co. has been organized at Washington, D. C., by MORRIS MURPHY, E. A. ADAMS, and FRANK E. HOPKINS. Capital stock, $25,000.

Gas Engines.—The Terre Haute Gas Engine Co. has been organized at Terre Haute, Ind., by NEWTON ROGERS, J. A. WHARRY, and JOS. H. BRIGGS. Capital stock, $500,000.

Natural Gas.—A natural gas company has been organized by R. J. STONEY, of Pittsburg, Pa.; H. W. WILSON, and WM. D. OWENS, of Indiana, Pa., and T. J. CUTLER, of Punxsutawney, Pa.

BRIDGES AND CANALS.

Bridge Notes.—***Bangor, Me.***—The contract for the new abutments of the Kenduskeag bridge has been awarded to the Jewell Granite Co., of Bangor.

Newburyport, Mass.—The City Council has appropriated $1,000 for bridges and culverts.

Holyoke, Mass.—Proposals for the masonry of the bridge over the Connecticut river, between Holyoke and South Hadley, will be opened May 13 by LEONARD CLARK Springfield, Mass.

Quincy, Mass.—The City Council has appropriated $20,000 for the Neponset bridge, and $2,400 for bridge repairs.

Fultonville, N. Y.—The State will build a new and wider bridge over the canal.

Wakefield, N. Y.—A bridge is to be built over the Bronx river, in Westchester Co., to the New York side.

Gowanda, N. Y.—A new bridge is to be built across Cattaraugus creek at a cost of $6,000 to $8,000 for the superstructure, and $2,500 to $3,000 for abutments.

Lancaster, Pa.—The Court has ordered a bridge built to carry the State road over Kelly's creek, in Martic township.

Frederick, Md.—The Commissioners of Frederick Co. will receive bids for a bridge across the Monocacy river.

Buena Vista, Va.—The Buena Vista Co. will build a bridge over the river.

Pineville, Ky.—The West Pineville Land Co. has awarded a contract for a bridge over the Tennessee river to the King Iron Bridge & Mfg. Co., of Cleveland, O.

Nashville, Tenn.—The Tennessee Midland Ry. Co. has had plans prepared for its Tennessee river bridge.

Centreville, Tenn.—The Columbia Bridge Works, of Dayton, O., have a contract for a bridge over the Duck river.

Jasper, Tenn.—The contract for a bridge over the Sequachee river has been awarded to the King Iron Bridge & Mfg. Co., of Cleveland, O.

Chattanooga, Tenn.—The Hamilton County Commissioners will receive bids for the Tennessee river bridge until June 1.

Madison, Ga.—The contract for a bridge over the Appalachie will be let May 23 by CHAS. W. BALDWIN.

Montgomery, Ala.—It is proposed to issue bonds for a bridge over the Alabama river. For particulars address Mr. W. F. VANDIVER, President of the Board of Trade.

New Orleans, La.—Mr. T. C. CLARKE, M. Am. Soc. C. E., of New York, has been looking over the proposed sites for the bridge to be built by the New Orleans Terminal Railway & Bridge Co. It is proposed to have two pivot spans, giving one opening of 440 ft., and two of 240 ft. Mr. W. VAN BENTHUYSEN is president of the company.

Columbus, O.—City Engineer MARBLE is preparing to let the contracts for the superstructure of the Buckeye St. bridge.

Hillsdale, Ind.—The contract for the abutments of Little Raccoon creek bridge has been awarded by the County Commissioners to John Schneider, of Alliance, O., at $2,309.50.

Logansport, Ind.—The Commissioners of Cass Co. will receive bids until May 21 for two wrought-iron truss bridges, one over the Wabash, with 4 spans of 141 ft., and the other over the Eel river with 3 spans of 124 ft.; roadways 20 ft. wide, with two 6-ft. sidewalks. No iron to be strained over 13,000 lbs. per sq. in. in tension, or 8,000 lbs. in compression or shearing.

Melrose, Minn.—A bridge is to be built over Sauk river. S. F. ADAMS, of St. Paul, is the engineer. The contract will be let to-day.

Denver, Col.—A. M. VAN AUKEN, C. E., Opera House Block, will receive bids until June 1 for three iron highway bridges for the Massasoit Improvement Co.

New Westminster, B. C.—The Fraser river railway bridge will have a draw span of 100 ft.

Indian Head, Man.—It is proposed to build a stone bridge over the Qu'Appelle river at Ketepwa. The Bridge and Road Committee is in charge.

The Louisville & Nashville Ry. is said to intend building stronger iron bridges between Louisville and Cincinnati.

The Philadelphia & Erie Ry. is replacing several wooden bridges and trestles with iron structures.

Cumberland River Improvement.—Holmes & Wills, of Nashville, Tenn., have the contract for the excavation and construction of the foundation for the first lock in the Cumberland river, Tennessee. The contract price is $70,000. The lock will be 52 x 280 ft. The contract for walls, 30 ft. high, 14 ft. wide at the bottom, and 6 at the top, will be let in a few months. Col. J. W. BARLOW is engineer in charge.

The San Francisco Bridge Co., of San Francisco, Cal., has bought out the pile driving and bridge building business of the firm of Allen & Nelson for $12,000. During the 6 years Messrs. Allen & Nelson have been conducting their business they constructed all the bridges on the Puget Sound Shore railway; on the Cedar river extension of the Columbia & Puget Sound; rebuilt the high bridges between Renton and Coal creek, and also built bridges on the Seattle, Lake Shore & Eastern and West Coast roads. The San Francisco Bridge Co. will make such additions to the plant they have just secured as will enable them to execute with dispatch all the work they may be able to secure in the line of pile-driving, wharf and bridge building, dredging or steam shovel excavation.

Holyoke Bridges.—The following proposals for bridges on Dwight St. and Cabot St. have been received by the Bridge Committee, Holyoke, Mass.:—John E. Buddington, New Haven, Conn.: Dwight St., plank roadway, $9,789; granite roadway design B, $14,889, or B 1, $13,304; Cabot St. plank, $7,788, granite, $11,995, or B 1, $10,995; allow for present bridge on Dwight St., $450, removal to Cabot St., $1,055. R. F. Hawkins & Co., Springfield, Mass.: Dwight St., plank, $9,195, granite, $13,368; Cabot St., plank, $7,545, granite, $11,410. For present Dwight St. bridge, $250; removal to Cabot St., $1,300. Berlin Iron Bridge Co., East Berlin, Conn.: Dwight St., plank, $8,550, granite, $14,880. Cabot St., plank, $7,080, granite, $12,670. For present Dwight St. bridge, $1,000; removal to Cabot St., $900. Penn Bridge Co., Beaver Falls, Pa.: Dwight St., plank, $11,618, granite, $18,175. Cabot St., plank, $9,762, granite, $14,684; removal to Cabot St., $3,730; refused to bid for present Dwight St. bridge. Groton Bridge Co., Groton, N. Y.: Dwight St., plank, $9,750, granite, $15,215. Cabot St., plank, $9,200, granite, $13,035; for present Dwight St. bridge, $3,000; removal to Cabot St., $1,500. King Iron Bridge & Mfg. Co., Cleveland, O.: Dwight St., plank, $9,203, granite, no bid. Cabot St., plank, $7,116, granite, $11,978; for present Dwight St. bridge, $500; removal to Cabot St., $4,516. Wrought Iron Bridge Co., Canton, O.: Cabot St., plank, $7,700, granite, $14,120; no other bid.

ELECTRICAL.

Electric Light.—***Amherst, Mass.***—The Amherst Electric Light Co. has been incorporated. President, F. E. PAIGE; Treasurer, G. P. WARNER. Capital stock, $15,000.

Pittsfield, Mass.—The Pittsfield Electric Light Co. has a contract for street lighting. It will continue the present 42 arc lights and put in 200 incandescent lights of 16 c. p. The company will enlarge its plant.

Bath, N. Y.—The village trustees have contracted with the New Jersey Electric Light Co. for 40 street lights at $500 a year.

Holley, N. Y.—The electric light company has decided to award the contract for plant to the Western Electric Light Co., of Chicago.

Batavia, N. Y.—The Consumers' Electric Light Co has a contract for 3 years at $4,500, $3,700 and $3,500 respectively; 45 lights to burn till midnight at $54.81; and 15 lights all night at $84.45.

Fulton, N. Y.—The Citizens Electric Co. has made a proposition to light the village streets during the coming year at $47 per light.

Newark, N. Y.—The Newark Electric Light Co. has made a proposition to furnish 40 arc lights of 2,000 c. p. for 26 nights per month at $2,400 a year.

Albion, N. Y.—The Mutual Electric Light Co., of Brooklyn, has made a proposition to furnish arc lights at $52 each per year, and incandescent lights for domestic use at 1 ct. per hour.

Kearny, N. J.—The contract with the Leonard & Ellis Electric Light Co. has been annulled, and the Town Clerk will advertise for new bids.

New Castle, Pa.—Contracts for arc electric lighting will be received until May 25 by J. H. MILLER, City Clerk.

McKeesport, Pa.—The McKeesport Electric Light Co. has made an offer to light the business and most populous districts with 25 powerful arc lamps for about $3,000 per year. This the borough authorities think too much money, as about 100 gas lamps would still be necessary.

Pittsburg, Pa.—The People's Light & Power Co. has been incorporated by WILLIS L. EATON, THEO. KLOMAN and JOHN E. RIDALL. Capital stock, $10,000.

Abingdon, Va.—The Abingdon Water-Works Co. proposes to put in an electric plant. President, T. P. TRIGG.

Lynchburg, Va.—Dr. E. H. MURRELL, of Washington, D. C., representing the Bowen Electric Light & Traction Co., proposes to organize an electric light and power company.

Tarboro, N. C.—The city has voted to issue bonds for electric lighting for streets and dwellings. W. E. FOUNTAIN is Mayor.

Bainbridge, Ga.— A contract has been made with the Edison Electric Co. for a plant.

Thomasville, Ga.—The Thomson-Houston Co. is putting in the electric light plant.

Fernandina, Fla.—The Fernandina Light & Power Co. is putting in a 50 arc light plant of the Thomson-Houston system.

Decatur, Ala.—The electric light companies of Decatur and New Decatur have been bought out by the Thomson-Houston Co., which will put in a new plant.

Baton Rouge, La.—The gas and electric light companies have been consolidated as the Baton Rouge Gas, Electric Light & Power Co. Capital stock, $60,000.

Evansville, Ind.—Electric lighting is contemplated and a committee has inspected the Jenney plant at Fort Wayne.

Cadillac, Mich.—A contract for 18 arc lights, on the moonlight schedule, has been made with the Cummer Electric Light Co.

Pana, Ill.—The Pana Electric Light Co. has been incorporated by A. B. CORMAN, WM. H. NEWCOMB and GEO. V. PURCELL, Capital stock, $10,000.

Chicago, Ill.—The Council has appropriated $220,000 for extending the electric light plant.

Centralia, Wash. Ty.—The Centralia Electric Light & Power Co. has been incorporated by W. E. PARTRIDGE, T. H. BARNUM, O. H. RONANS, and others. Capital stock, $25,000.

Winnipeg, Man.—The Manitoba Electric Light Co. has decided to put in an incandescent plant, and wil have it in operation by July.

The Thomson-Houston Electric Light & Power Co. has been incorporated at St. Paul, Minn., by H. W. TURNER, F. B. FLEETHAM, and C. A. DAIGH. Capital stock, $500,000.

Springfield, Mass.—The Council has passed the order authorizing the Street Lighting Committee to make a new contract for electric lights. It provides that the lights shall burn all night; they are to be arc electric lights of 1,200 standard, and not less than 800 actual c. p. each. The contract is to be for a term of 5 years, and the price will be $83.33⅓ per light per year. The number of lights will not be less than 300, and as many additional as the city may wish at the same price. The contract will be made with the United Electric Co. There are now 55 electric lights in operation, which cost the city $12,045 a year, or $219 a light. The standard c. p. of the present lights is 2,000, with an actual c. p. of between 900 and 1,200. While the new lights will have but 1,200 c. p., the actual standard will be between 800 and 1,000 c. p.

WATER AND MUNICIPAL.

Irrigation in California.—Governor COOPER has signed Senate Bill No. 248, an act to provide for the diversion of the unappropriated waters at or near the sources of the Grand, Laramie and North Platte river systems and their tributaries, and to cause said waters to flow eastward through passes, cañons and breaks in the continental divide into and through the tributaries of the South Platte and Arkansas river systems for irrigation and other purposes; to regulate the distribution and disposition of said waters when diverted in accordance with the rights of appropriation thereof; to appoint a commission to carry out such work; and to appropriate money for preliminary expenses and to construct the necessary dams, canals and water-works to effect such diversion of water, and for salaries and expenses incident thereto.

Water Power.—The Broken Bow Canal & Improvement Co. has been incorporated in Nebraska, for the purpose of constructing and maintaining water power on the Dismal river. Capital stock, $500,000. The incorporators are: JOHN C. MAULICK, JOHN REESE, D. M. AMESBURY, S. B. THOMPSON, H. J. HEDGES, CHAS. CLOMAN and J. H. INMAN.

New Haven, Conn.—The Board of Public Works has issued its report for 1888. The report of City Engineer A B. HILL describes the work done during the year under his supervision. Among the most important work was a steel plate girder bridge over the Mill river at State St. and the straightening of West river. Tables are given of the street and sewer work done, prices of bids and contracts, etc.

Poughkeepsie, N. Y.—The Water Commissioners have issued their report for 1888. During the year 1,088 ft. of 6-in. pipe and 25 ft. of 4-in. hydrant branches were laid also 3 gates and 3 hydrants set. The pumpage was less than during 1887, owing to repairs in the pumping plants. The Commissioners again call attention to the fact that the city is still dependent upon a single pumping station, which has been in use for 16 years, and urge the necessity of putting in a duplicate pumping plant. Much trouble was experienced with the rapid growth of algæ, and it is recommended that the clear-water basin be roofed over to prevent the growth of algæ in the filtered water. There are now 18.6 miles of pipe. CHAS. E. FOWLER is superintendent. The cost of filtration is stated to be $1.32 per million gallons.

Plainfield, N. J.—At a Council meeting on May 7, the Committee on Water-Works and Sewerage presented a report in which they recommended that the city build and operate its own works, and that an engineer be engaged to prepare plans and specifications for a complete system of water supply and sewerage, upon which plans proposals should be invited. The report was approved.

Dartmouth, N. S.—A meeting of the ratepayers was held recently to consider the advisability of adopting the act passed at the last session of the Legislature authorizing the citizens to supply themselves with water and sewerage. The act was amended during its passage through the House, making it necessary to hold another public meeting to ratify the act before it could go into operation. After a lengthy discussion, Councillors Johnstone and Creighton moved that the act be adopted. J. R. Orman and H. C. Walker moved in amendment "that the meeting stand adjourned until this night 12 months." After discussion the amendment was carried by a vote of 111 to 103.

Gas Works.—***Dalton, Ga.***—The Dalton Gas Co. has been organized by R. L. PEAK, D. C. BRYANT and T. O. TROTTER. Capital stock, $30,000.

Port Townsend, Wash. Ty.—It is reported that a gas company is being organized in competition with the electric light company.

Wilmington, Del.—The following proposals for a pump with a daily capacity of 2,700,000 galls. were opened April 30 by the Water Commissioners: A. J. L. Loretz, Brooklyn, N. Y.: beam engine, Cornish type; high and low-pressure cylinders, 18 and 36 ins.; pump cylinder, 18 ins.; stroke, 40 ins, $11,000. Traynor & Co., Wilmington: triple expansion Davidson engine; 12, 18 and 34-in. cylinders; 20-in. pump, 24-in. stroke, $12,400. R. Moreland & Co., Toronto, Can.: triple expansion; 12¼, 19 and 33-in. cylinders, 12¾-in, pump, 36-in. stroke, $15,580. Robt. Wetherill & Co., Chester, Pa.: Corliss engine; 17 and 32-in. cylinders, 13¾-in. pump, 30-in. stroke, $13,500; or 14 and 26-in. cylinders, 11½-in. pump, 30-in. stroke, $9,500. H. R. Worthington, New York: high duty engine; cylinders 15 and 30 ins., pump 16 ins., stroke 24-ins., $16,049. Remington Machine Co., Wilmington: Corliss engine, Hall pump; cylinders 15 and 30 ins., 13½-in. pump, stroke 30 ins., $9,000; or 14 and 28 ins., 12½ ins., 30 ins., $8,200. Holly Mfg. Co., Lockport, N. Y.: Gaskill engine; cylinders 14 and 28 ins., pump 15 ins., stroke 24 ins., $13,500; or 12 and 24 ins., 14 ins., 22 ins., $9,500.—The following proposals were received for a filter plant with a daily capacity of 500,000 galls.: Jewell Pure Water Co., Chicago, Ill., 4 open filters, $10,800. Cumberland Mfg. Co., Boston, Mass., 4 Warren filters, $14,500. Hegeman & Oliphant Co., New York, 4 filters, $15,000. National Water Purifying Co., New York, 4 open filters, $16,500. W. H. Green, Chester, Pa.: 4 filters, $18,000. U. S. Sanitary Filter Co., New York: 4 filters, $45,000; 6 filters, $47,000.

Fort Sheridan, Ill.—Proposals for constructing a water supply system at Fort Sheridan have been received by Capt. C. P. MILLER, U. S. A., of Highland Park, Ill., and transmitted to Washington, where the awards will be made. For the water tower, 9 bids were received, ranging from $42,396 by Williams & Co., of Chicago, to $64,054 by the Northwestern Construction Co., of Chicago. For the pipe system there were 12 bids, the lowest being $16,839 by W. R. Keeney, of Highland Park, and the highest, $31,974, by James Sweetzer, of Chicago. The bids for the lake inlet were as follows: Alvord & Johnson, Chicago, $8,125; J. G. Fallon, Lake View, $8,250; Geo. C. Morgan, Chicago, $8,300; James Sweetzer, Chicago, $11,000. The bids for pumping plant were as follows: C. S. Sudo, Chicago, $12,787; Geo. C. Morgan, Chicago, $12,960; Deane Steam Pump Co., Holyoke, Mass., $13,400; North Western Contracting Co., Chicago, $13,400; Williams & Co., Chicago, $14,000; H. R. Worthington, New York, $16,232; A. J. Loretz, Brooklyn, $21,000.

Tarrytown, N. Y.—The following proposals have been received by SAMUEL B. LEACH, engineer for the Water Commissioners:—Well: C. L. Kalmbach, $2,850; I. O. Merritt, $3,250. Pump: Knowles Steam Pump Co., $2,200; Buffalo Steam Pump Co., $2,475; Deane Steam Pump Co., $2,800 and $3,200; H. R. Worthington, $3,100; Gordon Steam Pump Co., $3,500; Davidson Steam Pump Co., $4,000. Boilers: S. C. Forsaith Machine Co., $1,100; B. W. Payne & Co., $1,100. Pipe: M. J. Drummond, $8,980.49; Jackson, Woodin & Co., $9,062.81; Pancoast & Rogers, $9,144; John FOX, $9,184.48; B. Van Vranken, $9,268.82; McNeal Pipe Foundry, $9,373.50. Pipe laying: Van Houten & Cummings, $4,369.46; E. E. Eglee, $4,845.50; J. O. Merritt, $5,724.15; Fogg & Scribner, $5,903.10; Joseph Hyde, $6,074.60; Timothy Hayes & Co., $7,262.75. The water will be taken from an open well about 50 ft. deep and pumped through a 10-in. pipe to the main reservoir for supplying the principal part of the village, and through a 6-in. pipe to a high-service reservoir for supplying the elevated portion of the village. About 6 miles of 4, 6 and 10-in. pipe will be laid.

Norfolk, Neb.—A survey of the main Elkhorn river shows that there is a fall of about 20 ft. in less than ¾ mile, which will afford sufficient water power for all manufacturing that will be done in the city. Propositions are being received by the engineer in charge, Mr. GEO. A. LATIMER, for its development and transmission to the city by electricity. Mr. LATIMER states that the scheme is a feasible one and worthy the attention of electric light contractors, besides being of interest to the business men of the city.

Water-Works.—***Maine.***—Ellsworth. The Citizens' Water Co. has been organized. Chairman, F. B. AIKEN; Clerk, GEO. R. CAMPBELL.

Massachusetts.—Beverly. An appropriation of $5,000 has been made for the pumping station.—Brookfield. The pipe from the reservoir and through the village has been laid and domestic services are being put in. C. B. CARPENTER is Commissioner.—Quincy. The Council has appropriated $3,400 for hydrants.—Newburyport. The Council has appropriated $7,600 for water supply.—Newton. Extensions are contemplated. There are now 90 miles of pipe, 600 hydrants, 300 meters and 400 services, H. N. HYDE, JR., is Superintendent.

New York.—Pike. The estimated cost of the new works is $10,000. The supply will be taken from the Emery spring, and there will be a reservoir of 60,000 bbls. capacity.—Rochester. In consequence of the necessity of the expenditure of a large amount of money for an additional conduit, it is proposed to limit the appropriation for pipe extensions during the present year to $40,000 or $50,000.—West Troy. The only bid for a watersupply was from the Green Island Water Co., $10,000, the same as paid last year; $8,000 has been voted for this purpose and 5 more fire plugs are required.—Saratoga Springs. The water in the reservoir is said to be in bad condition.

Pennsylvania.—Selinsgrove. The party opposed to the water-works has filed a bill in equity to restrain the tax collector and the Selinsgrove Water Co. from collecting taxes; they claim that the works are not sufficient for fire purposes.

Virginia.—Roanoke. C. H. CLARK has been elected president of the water-works, and H. E. GERHARDT, secretary.—Abingdon. The Abingdon Water-Works Co. has been organized. Capital stock, $20,000. President, T. P. TRIGG.—Warrenton. For particulars of the proposed works address the mayor.

West Virginia.—Charlestown. The Charlestown Water & Mfg. Co. will open bids May 15 for furnishing and laying 8,500 ft. of 6-in. and 1,500 ft. of 4-in. pipe, 10 gates, 1¼ tons of specials, duplex pump of 200 galls. per minute, with gearing to connect with overshot water-wheel; also stand-pipe, 15 x 100 ft. T. G. BAYLOR is the engineer.

South Carolina.—Spartanburg. At a preliminary test on April 28 the water company threw streams from the hydrants to a height of 50 or 60 ft.

Georgia.—Augusta. The city has 30½ miles of pipe and 296 hydrants. About 5½ miles of pipe will be laid.—Brunswick. The water company will build an additional reservoir, 25 by 50 ft. and 13 ft. deep.—Columbus. A company is to be organized to supply water to the suburban districts.—Dalton. A company is being organized by T. R. JONES and others to purchase the water-works.—Elberton. The town has decided to build water-works, and correspondence is invited. Address the mayor, P. M. HAWES.—Fort Valley. Address J. D. MARSHALL in regard to the projected works.—Gainesville. Water-works are to be built. Address the mayor, FLETCHER M. JOHNSON.—Rome. About 320 ft. of pipe are to be laid.

Alabama.—Greenville. Material for new water-works will be wanted soon. Address J. R. PORTERFIELD.—Tuscumbia. Address the mayor for information as to the new water company.

Mississippi.—Jackson. At a test on April 30 the water company threw streams to a height of 50 ft. with stand-pipe pressure.

Tennessee.—Morristown. It is reported that the contract given to a New York firm has been annulled, and that new bids will be called for.

Kentucky.—Catlettsburg. Works will probably be built, but contracts cannot be let until January, as an act of the Legislature is necessary. Surveys and estimates have been made. For particulars address H. WELLMAN.—Harrodsburg. Water-works are wanted, with about 60 hydrants. For particulars address L. D. CARDWELL.—Mount Sterling. LEWIS APPERSON is president of the new water company.—Shelbyville. The Commonwealth Construction Co., of Philadelphia, Pa., has applied for a 20 years' franchise for water-works. The cost of the works will be about $30,000.

Ohio.—Findlay.—There is some dissatisfaction at the non-completion of the water-works, which have been under construction for 2 years.—Washington. The Washington Water Co. has been organized at Covington, Ky., by E. RANDOLPH, H. E. HUNTINGTON, and HARVEY MYERS. Capital stock, $150,000.

Indiana.—Franklin. The water-works ordinance has been passed, and a contract awarded to J. A. O'Neil, of Kansas.

Michigan.—East Saginaw. A new pumping engine is to be put in.

Illinois.—Alton. The Alton Water-Works Co. has increased its capital stock from $150,000 to $300,000.——Carlinville. The Carlinville Water Co. has been organized: President, W. G. REEVE, of Peru, Ill.; Vice President, A. H. BELL, of Carlinville; Secretary and Engineer, F. WM. RAEDER, of St. Louis, Mo. The stand-pipe is being erected, and the works will be completed in August.——Chicago. The City Comptroller opened bids May 6 for $225,000 water bonds.——Jacksonville. A legislative committee has been investigating to see if the water supply is sufficient to justify the enlargement of the Asylum for the Insane.——Peoria. The water-works ordinance has been passed by the council.

Wisconsin.—Madison. Bids for a storage reservoir were opened May 9 by E. M. NICHOLS, Superintendent of Water-Works.——Burlington. A company with a capital stock of $5,000 has been organized to furnish a water supply from artesian wells.

Minnesota.—Albert Lea. For particulars of the projected water-works, address F. A. JOHNSON, City Clerk.——Ely. The works have been tested, with satisfactory results.

Kansas.—Leavenworth. The Leavenworth Water-Works Co. is extending its pipe line and putting in new hydrants.

Wyoming.—Evanston. Water-works are projected.——Fort Russell. Water-works are to be built at a cost of $24,000.

Montana.—Helena. It is now proposed to pump a supply from the Missouri river to a reservoir above the city. The works would cost about $500,000. An engineer is to be engaged to make surveys.

Missouri.—Kansas City.—The National Water-Works Co. will make considerable improvements.——Sedalia. There are now 60 hydrants and 40 more are to be set this season.——Washington. The Interstate Water & Gas Works Co. has completed its reservoirs.

Arkansas.—Arkadelphia. Address A. S. GREENE in regard to projected water works.——Batesville. The Batesville Water Power & Irrigation Co. will build waterworks. Capital stock, $50,000.——Camden. The works are nearly completed.——Hope. A new pumping engine will be put in.——Mammoth Springs. The Mammoth Springs Water & Electric Light Co. has been organized. Capital stock, $50,000. President, ROBERT GREEN; Secretary, E. F. BROCK.——Russellville. Water-works are projected.

Texas.—Jefferson. The Jefferson Water Co. has been incorporated. Capital stock, $5,000.——Luling. The Luling Water Co. will put in works with 1 mile of 8-in. cast-iron and 4 miles of 4-in. wrought-iron pipe; standpipe 12½ by 100; pumping plant of 1,000,000 galls. daily capacity, run by a water-wheel. The water will be raised 180 ft. JOHN ORCHARD is Secretary.——McGregor. Waterworks are projected.——Taylor. The Taylor Water Co. has put in a new Worthington pump.——Waco. The Bell Water Co. has been organized by J. D. BELL, and others. Capital stock, $250,000.

Colorado.—Denver. The Mountain Water-Works Construction Co. has been organized by DAVID MOFFAT, WALTER S. CHEESEMAN, GEO. W. CLAYTON, and others. Capital stock, $50,000.——Greeley. The well is completed; it is 24 ft. deep and 14 ft. diameter; it has now 16 ft. of water, or 17,500 galls.——Pine Grove. A dam 40 ft. high is being built on Elk creek to form a reservoir to furnish water for domestic purposes.

Oregon.—Portland. The pipe system is being extended; 4, 10 and 12-in. pipe are used; 2,000 tons of pipe have been contracted for, and if it is all laid, the present pipage of the city will be doubled.

Washington Territory.—Port Townsend. The mayor has appointed a commission to investigate the present water supply, and it is thought a new supply from a mountain lake 9 miles distant may be recommended.——Roseburg. A water company has been organized by T. R. SHERIDAN, W. S. HAMILTON, S. C. FLINT, and others. Water will be pumped from the South Umpqua river to a reservoir of 1,000,000 galls. capacity at an elevation of 240 ft.——Roslyn. It is proposed to build water-works at a cost of $20,000.

California.—Ferndale. The Ricks Water Co. has let the contract for sheet iron and rivets for pipe to J. B. Stokes, of San Francisco.——San Miguel. The San Miguel Water Co. has been incorporated at Sacramento.

Utah.—Ogden.—The Committee on Water Supply has been granted further time to report on the proposition made by a syndicate to purchase the water-works.

Canada.—Ripon, Ont. No company will put in works unless 100 consumers for 20 years are guaranteed.——St. Catherine's, Ont. The city will expend $30,000 in extending the water-works system.

Special Reports of Water-Works Construction.

South Pittsburg, Tenn.—F. P. CLUTE, Secretary, So. Pittsburg Water-Works Co., sends us the following information:

The entire plant will be reconstructed during the coming season. A new 1,000,000 gall. pumping engine and mains to connect with the old works are now being put in. The supply at present is obtained from springs 500 ft. above the town. The pressure is reduced to 80 lbs. by the use of a pressure-reducing valve. The water pumped, will be taken from the Tennessee river, and used for manufacturing purposes only. President, J. L. GAINES.

Napoleon, O.—The following is from E. C. DODD:

It has not been decided whether the works will be built by the city or a company. Water will be taken from the Maumee river and furnished for both fire and domestic use. Estimated cost, $100,000. Population, $4,000.

Carbon, Wyoming.—F. P. CHANNON sends us the following:

An artesian well is now being sunk. Address J. O'CONNOR.

South Boston, Va.—The following information has been received from W. D. BARBOUR, Chairman Water Board:

The town will issue bonds for $15,000 and build works. Water will be pumped to a stand-pipe. Only five hydrants will be placed at present. C. A. BALLOU is Engineer. Population, 2,000.

Wytheville, Va.—The following details are from H. G. WADLEY:

The town has issued $25,000 of bonds and awarded the contract for a complete system of water-works to the Glamorgan Works, Lynchburg, Va. Work will begin May 1, and be completed Sept. 1. The supply will be taken from a limestone spring, and pumped to reservoir. Estimated daily capacity of spring, 200,000 galls. Engineer, R. T. GLEAVES. Mean elevation of town above the level of the sea, 2,300 ft. Population, 3,000.

Orangeburg, S. C.—The information given below was furnished by GEO. H. CORNELSON:

I have bought the water-works as now existing, and made a 10 years' contract to supply the city. Four miles of 6-in. and two miles of 4-in. pipe, together with 100 3-in. double nozzle hydrants and a 60,000 galls. per hour Worthington pump, will be placed at once. Shall add 20 ft. to height of stand-pipe. Two artesian wells will be bored if necessary.

Milledgeville, Ga.—The following was given by S. WALKER:

A gravity system of water-works will be constructed by a private company. The supply will be taken from springs. Estimated cost, $30,000. Population, 5,000.

Panhandle, Tex.—The following information is from A. L. MAYFIELD:

The Cook Well Co., St. Louis, Mo., are now sinking an artesian well. Water for drinking purposes is to be supplied from a tank. Estimated cost, $3,000. The works are owned by a private company and are to be completed in four weeks. Population, 350.

Franklin, Ind.—Regarding water-works at this place, JAS. A. O'NEIL, 25 Fletcher Ave., Indianapolis, formerly of Fredonia, Kan., sends us the following:

A franchise has been granted to JAS. A. O'NEIL to build works. There will be six miles of pipe and 60 hydrants. Hydrant rental, $3,500 per year.

Greensburg, Ind.—The following is from J. W. CRAIG:

A franchise was granted to SAMUEL R. BULLOCK, of New York City, about one year ago. The Greensburg Water Co. has been organized and is now ready to commence work. For information address the Engineer, E. F. FULLER, 11 Wall St., New York City.

Tybee, Ga.—The following information has been received from R. P. LOVELL:

The Tybee Artesian Water, Ice & Lighting Co. has been incorporated to build works. Capital stock, $5,000. If sufficient pressure can be obtained from the artesian well, the gravity system will be adopted. If not, water will be pumped to tank. Contractor for boring well and laying pipes, J. MULLIGAN. For pipe, fittings, etc., E. LOVELL'S SONS, Savannah. Work was begun May 6, and will be completed in thirty days. Population, 300.

Pleasanton, Kan.—S. H. ALLEN has sent us the following information:

Additional bonds to the amount of $5,000 have been voted. About 3,000 ft. of 6-in. 5,000 ft. 4 in. and 20 hydrants will be placed this season. Address, Chairman City Council. Supt., L. C. Cross. Population, 1,320.

Reading, Pa.—Engineer HOWARD MURPHY has submitted the plans for a new system of water distribution throughout the city. The plan is intended to equalize the pressure, and will involve the renewal of many of the mains which were laid at a time when it was not supposed that Reading would ever attain its present population.

Irrigation.—***California.***—The Woodbridge Canal & Irrigation Co. has been incorporated with the object of acquiring water rights on the Mokelumne river and other streams in San Joaquin and Calaveras counties. The capital stock is $300,000. The directors are M. V. B. WATSON, B. A. LAWS, N. E. GREEN, B. D. BECKWITH, and THOMAS CREIGHTON.

Gas Works—T. William Harris & Co., of New York, have the contract for extending the Tarrytown gas works at Irvington, N. Y.

Newburg, N. Y.—The Water Commissioners have issued their report for the year ending March 11, 1889. The rainfall for the year was 46.19 ins. It is recommended that measures be taken for the purification of the water supply. During the year 6,337 ft. of pipe was laid. The amount of water pumped was 77,863,680 galls. There are 245 gates and 242 hydrants. WM. C. MILLER is Superintendent and CHARES CALDWELL, Civil Engineer.

Water Power.—The Folsom Water Power Co., of California is planning to convey from 6,000 to 7,000 H. P. to Sacramento, 18 miles away, by the electric current. There is much talk, at least, of syndicates for farming out this power, and for paper mills, saw and planing mills, etc.

Extensions and Additions to Water-Works Systems Contemplated for 1889.

(See The Manual of American Water-Works for Addresses.)

(Continued from page 418.)

City or Town.	Pipe.	Hydrants.	Valves.	Meters.
Maine.				
Booth Bay	15,840 ft. 10,8,6 and 4-in	24	17	Unk'n
Portland	52,800 ft. 12,8 and 6-in	75	90	25
Rockland	21,120 ft. 6 and 2-in.	4	4	
N. Hampshire.				
Nashua	15,840 ft. Materials all bought	18	15	10
No. Conway	10,560 ft. 3 and 2-in.	6	4	
Vermont.				
Barre	3,000 ft. 12 to 4-in.	4 to 6		
Winooski	2,500 ft. 8-in.	Unknown		
Massachusetts.				
Dedham	*2,000 ft. 12 and 6-in	3		
Hopkinton	13,200 ft. 6 and 3-in	10		
New York.				
Cortland				25
Gouverneur	1,000 ft. 4-in.	2	3	
Homer	2,500 ft. 8 to 4-in.	"Can not say"		
Malone	4,000 ft. 4-in	3	6	
Medina	1,000 ft. 6-in	4	1	
Mt. Vernon				6
Saugerties		1		3
Worcester	250 ft. 2-in.		1	
New Jersey.				
Bridgeton	3,500 ft. 6 and 4-in.	8		
Camden	15,840 ft. 8-in.	40	80	30
E. Orange	5,000 ft. 6 and 4-in.	10		
Elizabeth	10,560 ft. 12 and 4-in	6	12	
Kearny	5,280 ft. 6 and 4-in.	9		
Millville	1,400 ft. 4-in.		18	
Mt. Holly	†4,800 ft. 12-in		14	
Washington	1,000 ft. 4-in.		5 or 6	
Delaware.			3	
Dover	1,950 ft. 4 and 2-in.		2	
Pennsylvania.				
Ashland	500 ft. 6 and 4-in.	Can not say		
Beaver Falls	11,880 ft. 8, 6, and 4-in	100 or 300	25	
Brookville	‡		3	
Clarion	2,000 ft. 4-in.		"Few"	1
Derry Station	1,000 ft. 6-in.	2	2	
Jermyn	2,000 ft. 4 and 3-in.	8	8	
Kennett Sq're	600 ft. 4-in.	2	2	
Lancaster	¶ 6,000 ft. 8 and 6-in	12	18	
Latrobe	7,920 ft. 6-in	4	8	
Lansdale	400 ft. 4-in.			
Lebanon	1,000 ft. 6-in.	8	4	7
Lockhaven	15,840 ft. 6 and 4-in.			
Mechanicsburg	26,400 ft. 10 and 6-in.	12 or 15	19	
Plymouth	2,400 ft. 4-in.		3	12
Sewickley	§2,640 ft. 6, 4, and 3-in.	4 to 6	4 to 6	
Shenandoah	6	Unknown		
Smithport	2,500 ft. 3-in.			
Tarentum	5,280 ft. 4-in.	75	11	
Ulysses	400 ft. 2-in.			
Maryland.				
Frostburgh	800 ft. 3 and 1¼-in.	15 or 20	Unknown	
Salisbury	5,280 ft. 6 and 4-in.	25	4	4
Virginia.				
Charlottesville	10,560 ft. 6 and 4-in.	6	4	
Richmond	25,000 ft. 6 and 4-in.	40	50	
West Virginia				
Charleston	**2,640 ft. 4-in		1	
North Carol'a				
Winston	2,500 ft. 6-in	6	2	30 to 50
Georgia.				
Atlanta	21,120 ft. 6-in. Material purchased	50	50	++ 300
Alabama.				
Tuscaloosa	2,640 ft. 8 and 6-in.	10	6	2
Tennessee.				
Jackson	6,000 ft. 6 and 4-in.	12	20	10
Kentucky.				
Maysville				30
Michigan.				
Detroit	126,720 ft. 10 to 4-in		200 to 250	100 to 150
Iowa.				
Cedar Rapids	10,560 ft. 6-in.	8 or 10	15 or 20	
Kansas.				
Minneapolis	‡‡			10
Nebraska.				
Plattsmouth	3,400 ft. 6-in.	8	3	10
Wyoming Ter.				
Rawlins	1,000 ft. 4-in.	4	8	
Montana Ter.				
Helena	5,000 ft. 4-in.		4	15
Arkansas.				
Little Rock		14		15 or 20
Texas.				
Galveston	¶68,900 ft. 24 to 6-in.	350	180	Unknown
Gonzales	3,000 ft. 6 to 1¼-in.	3		
Victoria	780 ft. 6-in.	1	1	
Utah.				
Salt Lake City	¶¶ 18,000 ft. 24 to 3-in	17	15	

* To erect a new stand-pipe; 42 ft. in diameter by 51 ft. high.

† A new 1,000,000-gall. Worthington pump and boiler to be placed. Also to erect new pump-house.

‡ Two small wooden tanks will be erected.

¶ Small pipes to be replaced by larger ones.

§ To increase capacity of reservoir 25 per cent.

** To begin new reservoir.

++ To be purchased by consumers.

‡‡ New stand-pipe to be erected, 20 ft. in diameter by 85 ft. high.

¶¶ Now building a new 6,000,000 galls. reservoir